US011043065B2

(12) **United States Patent**
McNierney et al.

(10) **Patent No.: US 11,043,065 B2**
(45) **Date of Patent: Jun. 22, 2021**

(54) **ELECTRONIC GAMING MACHINE INCLUDING MONITOR ARTICULATION MECHANISM**

(71) Applicant: **ARISTOCRAT TECHNOLOGIES AUSTRALIA PTY LIMITED**, North Ryde (AU)

(72) Inventors: **James McNierney**, Las Vegas, NV (US); **Kiran Uthamanthil Kizhakkeveedu**, Atlanta, GA (US)

(73) Assignee: **ARISTOCRAT TECHNOLOGIES AUSTRALIA PTY LIMITED**, North Ryde (AU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 100 days.

(21) Appl. No.: **16/578,983**

(22) Filed: **Sep. 23, 2019**

(65) **Prior Publication Data**

US 2021/0090382 A1 Mar. 25, 2021

(51) **Int. Cl.**
G07F 17/32 (2006.01)

(52) **U.S. Cl.**
CPC ***G07F 17/3216*** (2013.01); ***G07F 17/3213*** (2013.01); ***G07F 17/3223*** (2013.01)

(58) **Field of Classification Search**
USPC 463/46
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,440,457	A *	4/1984	Fogelman	A63F 13/08 463/46
7,758,429	B2	7/2010	Crivelli et al.	
9,881,443	B2	1/2018	Maher et al.	
10,181,236	B2 *	1/2019	Goldstein	G07F 17/3216
10,520,977	B2	12/2019	Mittler	
2008/0113821	A1	5/2008	Beadell et al.	
2009/0221375	A1	9/2009	Luciano et al.	
2018/0053373	A1 *	2/2018	Goldstein	G07F 17/3216

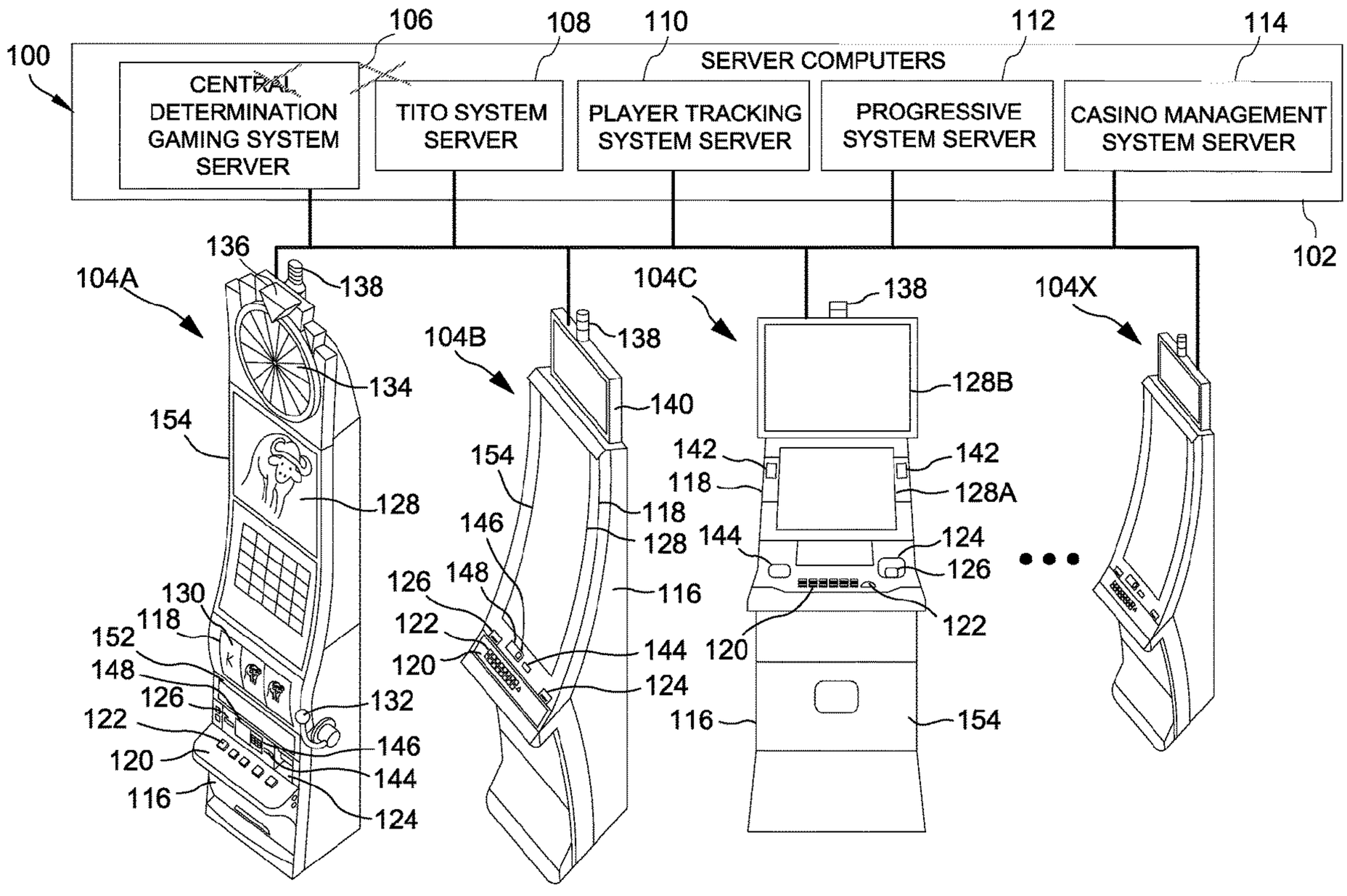
* cited by examiner

Primary Examiner — Pierre E Elisca
(74) *Attorney, Agent, or Firm* — Armstrong Teasdale LLP

(57) **ABSTRACT**

An electronic gaming machine includes a cabinet defining an internal compartment and an access opening that provides access to the internal compartment, a monitor positioned within the access opening, and an articulating support frame positioned within the internal compartment and operatively coupled to the monitor. The monitor is moveable by the articulating support frame along a first, linear path of motion from a first, closed position to a second, intermediate position, and along a second, arcuate path of motion from the second position to a third, open position.

20 Claims, 13 Drawing Sheets



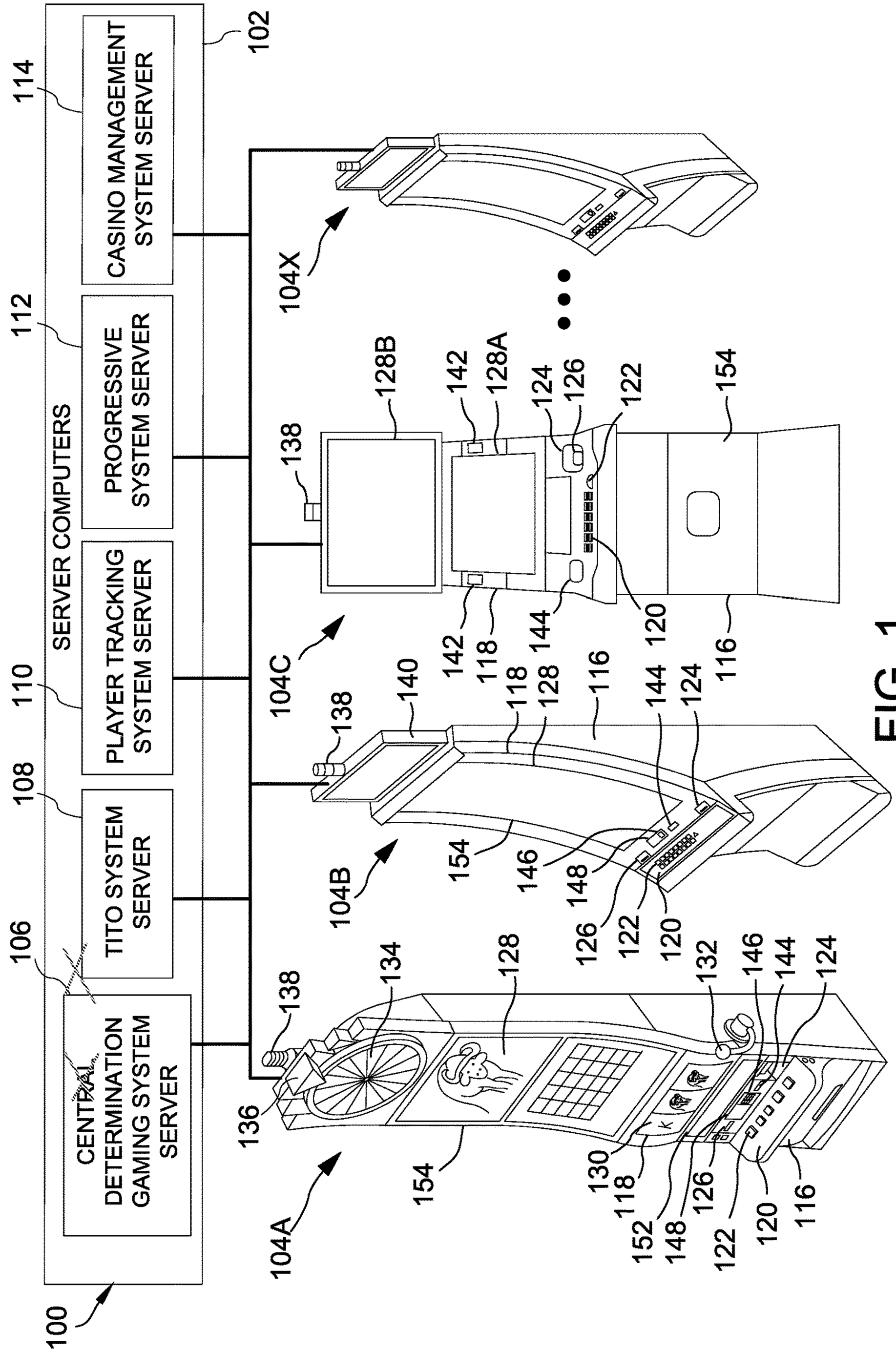

100
102
106
108
110
112
114
SERVER COMPUTERS
CENTRAL DETERMINATION GAMING SYSTEM SERVER
TITO SYSTEM SERVER
PLAYER TRACKING SYSTEM SERVER
PROGRESSIVE SYSTEM SERVER
CASINO MANAGEMENT SYSTEM SERVER
104A
104B
104C
104X
116
118
120
122
124
126
128
128A
128B
130
132
134
136
138
140
142
144
146
148
152
154

FIG. 1

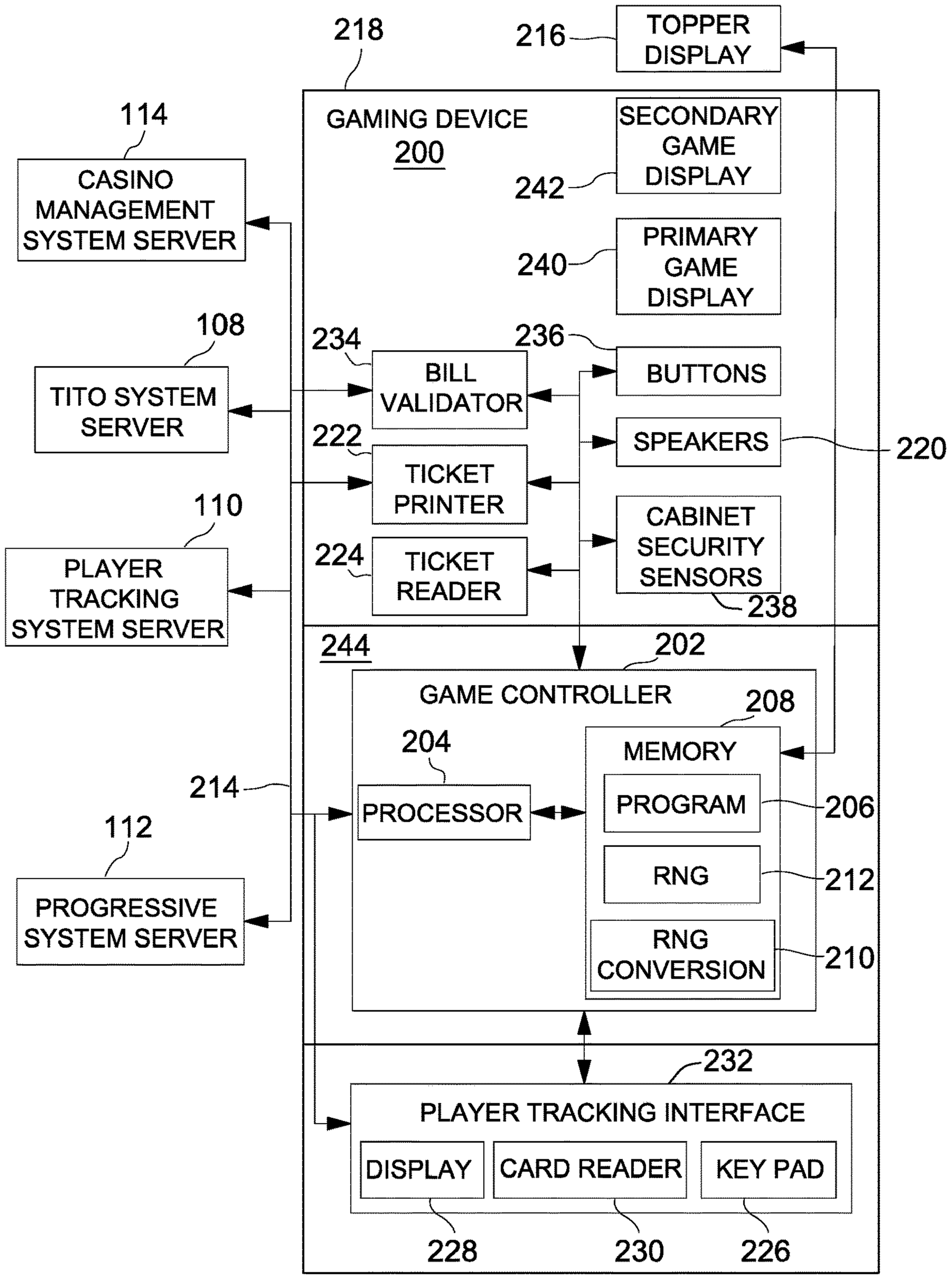

218
216
TOPPER DISPLAY
GAMING DEVICE
200
SECONDARY GAME DISPLAY
242
114
CASINO MANAGEMENT SYSTEM SERVER
PRIMARY GAME DISPLAY
240
108
234
236
BILL VALIDATOR
BUTTONS
TITO SYSTEM SERVER
222
SPEAKERS
220
TICKET PRINTER
110
CABINET SECURITY SENSORS
PLAYER TRACKING SYSTEM SERVER
224
TICKET READER
238
244
202
GAME CONTROLLER
208
204
MEMORY
214
PROCESSOR
PROGRAM
206
112
RNG
212
PROGRESSIVE SYSTEM SERVER
RNG CONVERSION
210
232
PLAYER TRACKING INTERFACE
DISPLAY
CARD READER
KEY PAD
228
230
226

FIG. 2

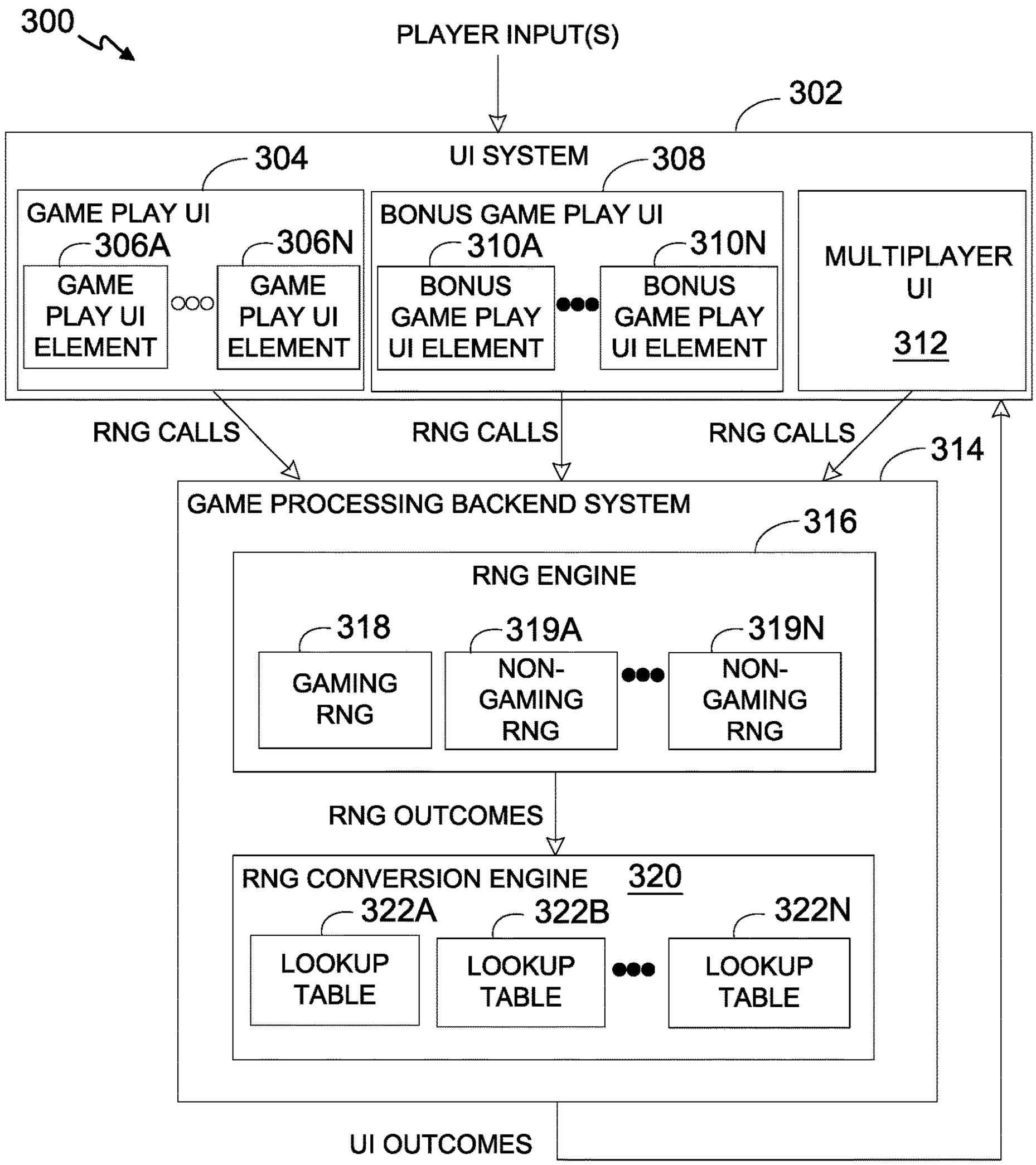

300
PLAYER INPUT(S)
302
304
UI SYSTEM
308
GAME PLAY UI
306A
306N
GAME PLAY UI ELEMENT
GAME PLAY UI ELEMENT
BONUS GAME PLAY UI
310A
310N
BONUS GAME PLAY UI ELEMENT
BONUS GAME PLAY UI ELEMENT
MULTIPLAYER UI
312
RNG CALLS
RNG CALLS
RNG CALLS
314
GAME PROCESSING BACKEND SYSTEM
316
RNG ENGINE
318
319A
319N
GAMING RNG
NON-GAMING RNG
NON-GAMING RNG
RNG OUTCOMES
RNG CONVERSION ENGINE
320
322A
322B
322N
LOOKUP TABLE
LOOKUP TABLE
LOOKUP TABLE
UI OUTCOMES

FIG. 3

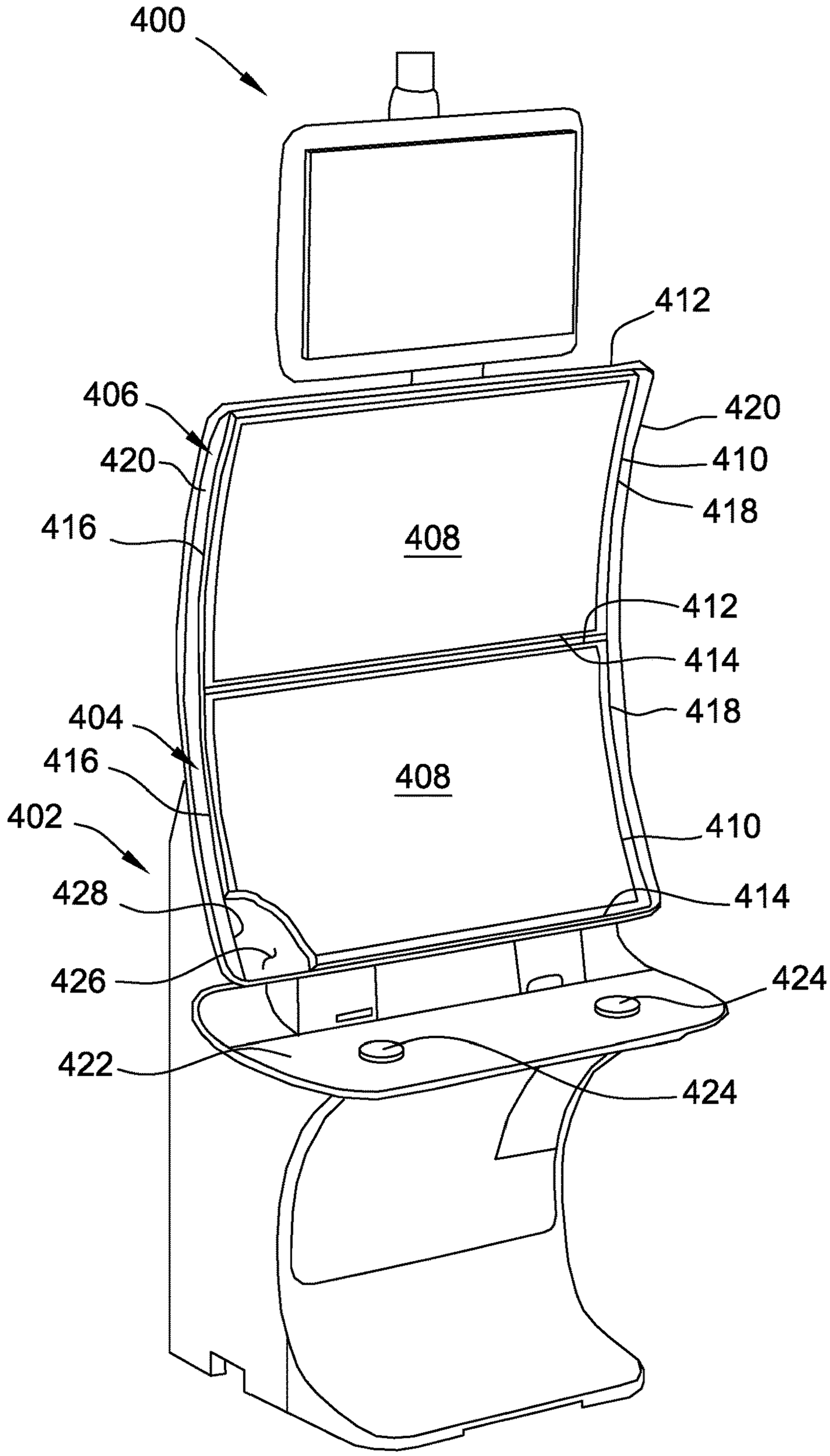

400
412
406
420
410
420
418
416
408
412
414
418
404
416
408
402
410
428
414
426
424
422
424

FIG. 4

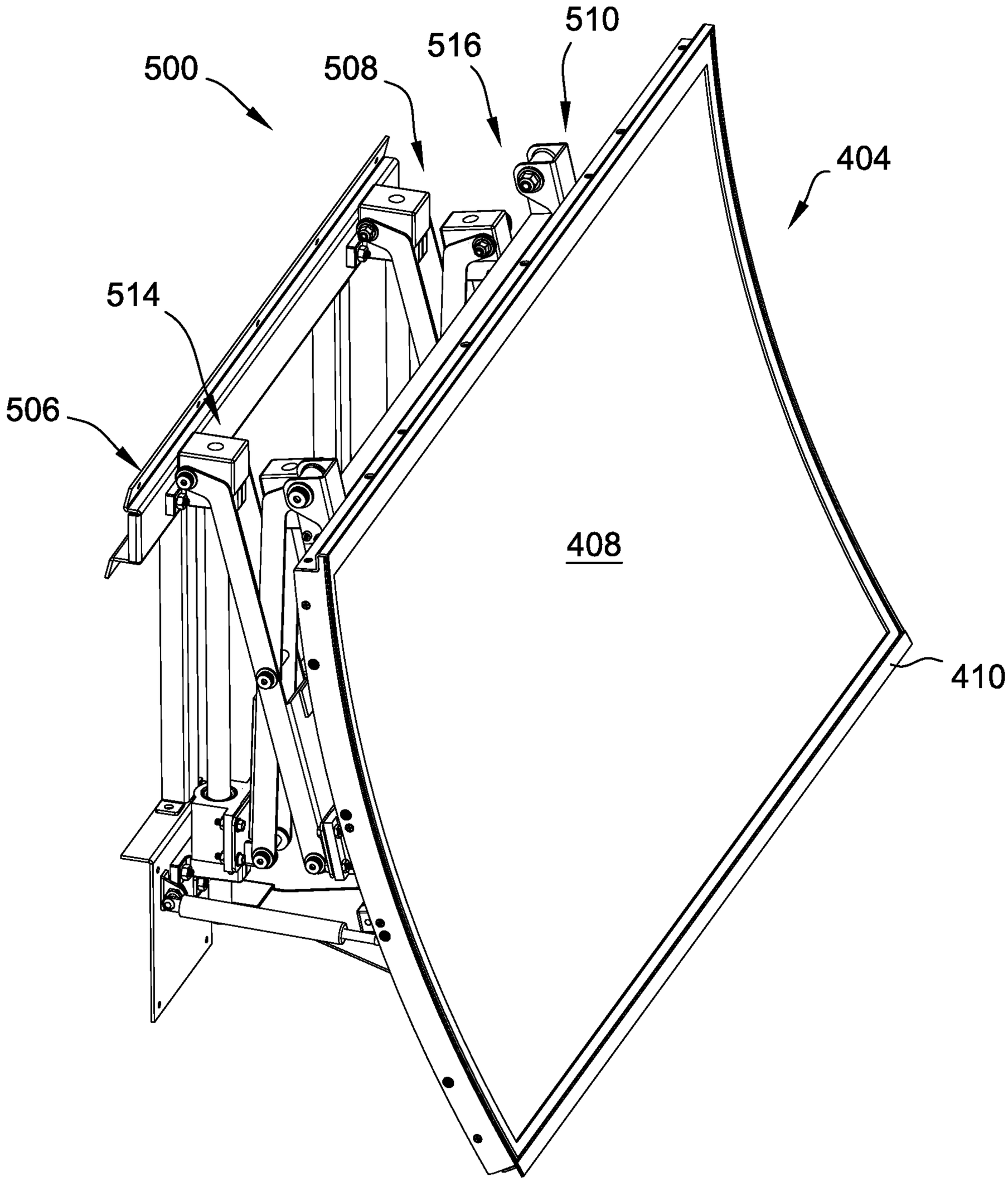


FIG. 5

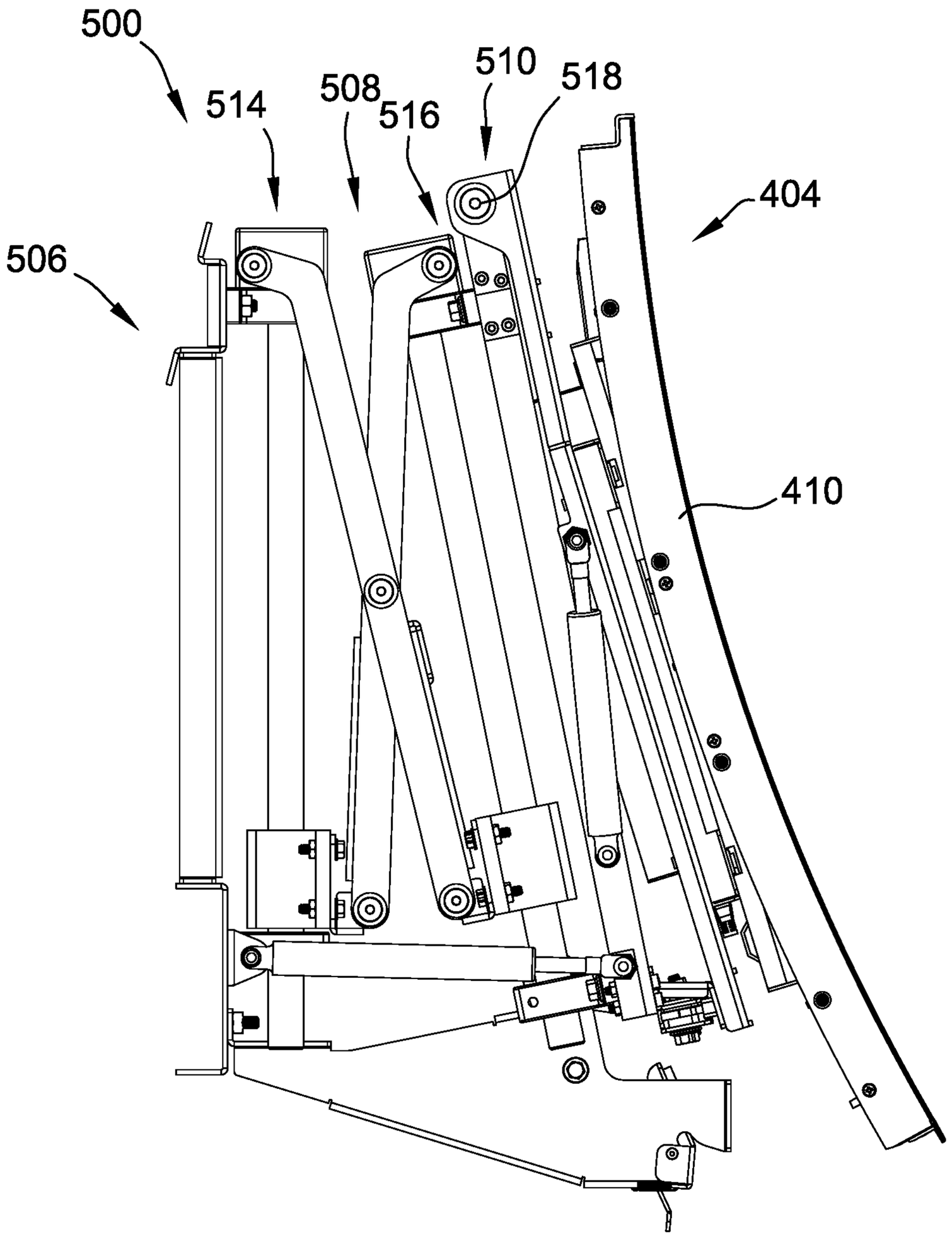


FIG. 6

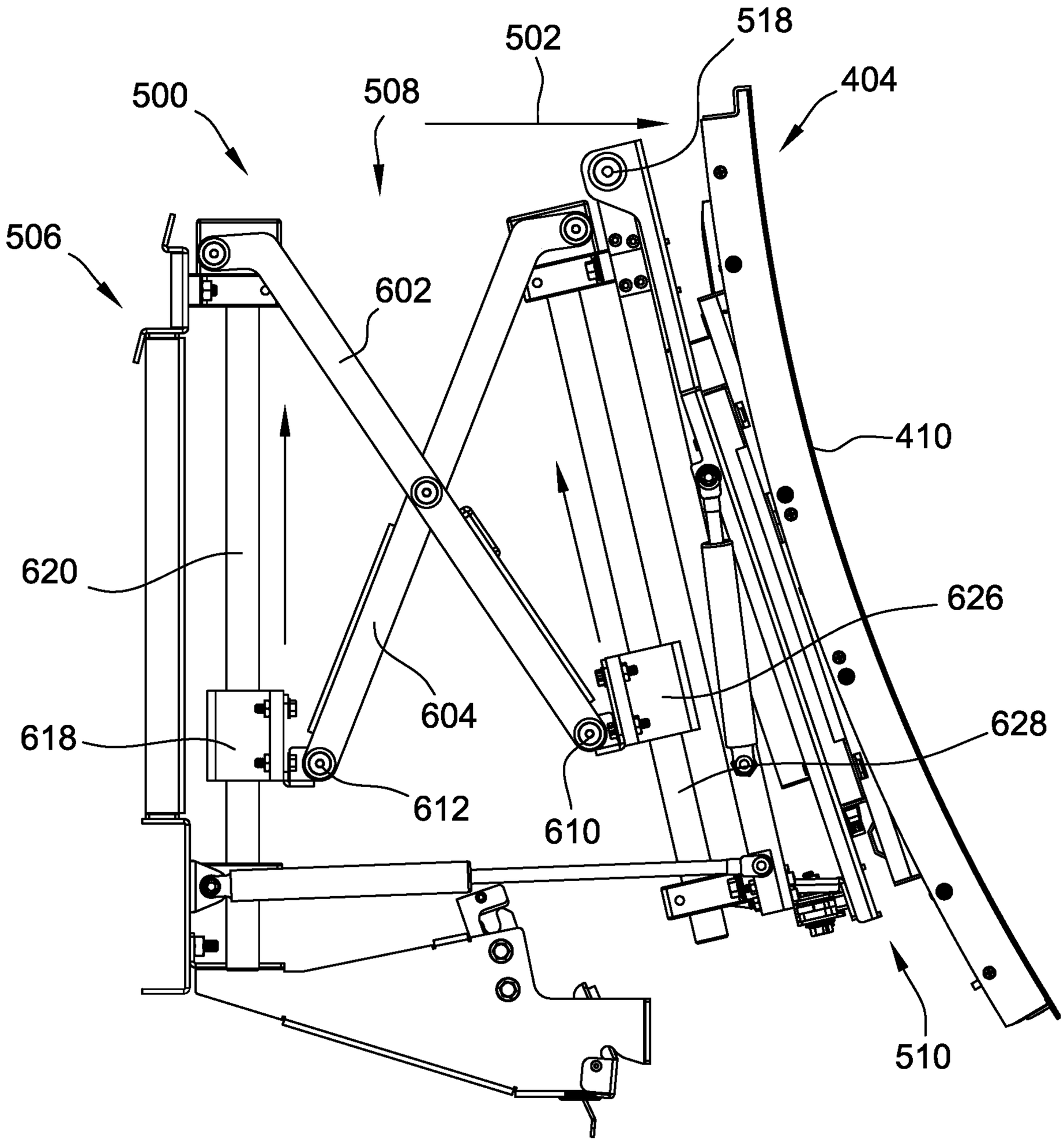


FIG. 7

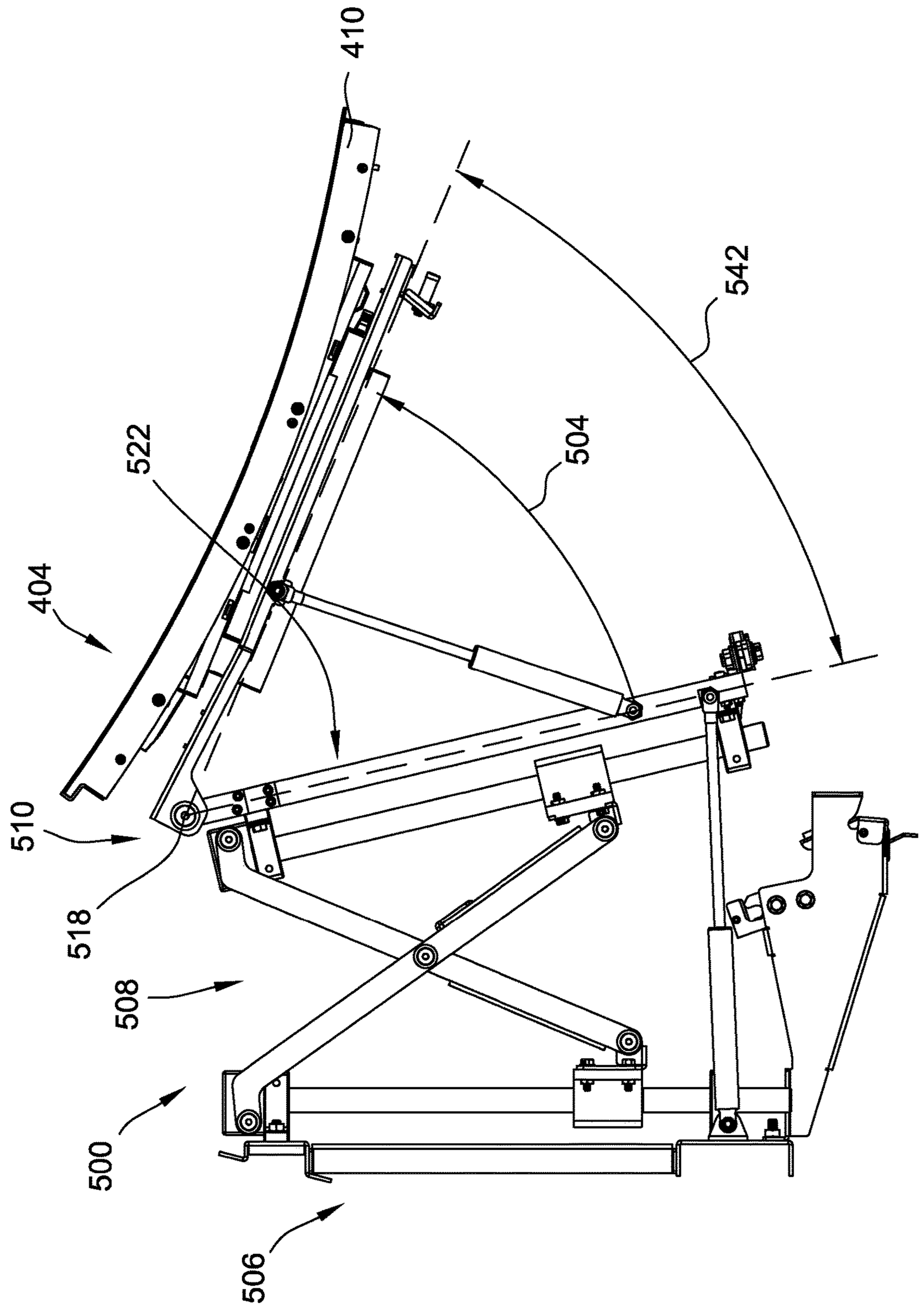


FIG. 8

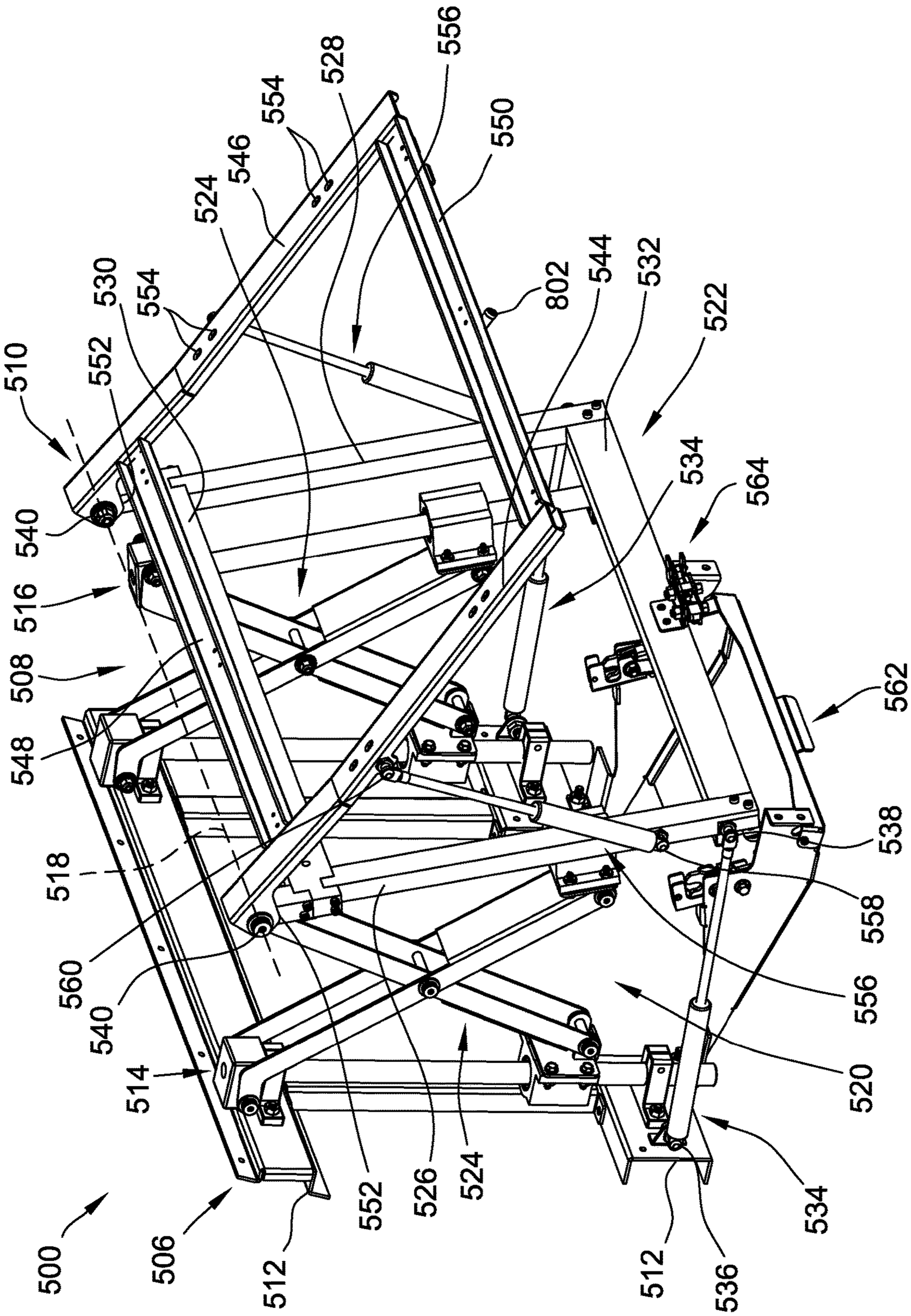

556
528
554
550
546
524
544
532
802
530
554
522
552
510
534
564
540
516
508
562
548
538
518
558
560
556
540
520
514
534
552
526
524
512
536
506
500

FIG. 9

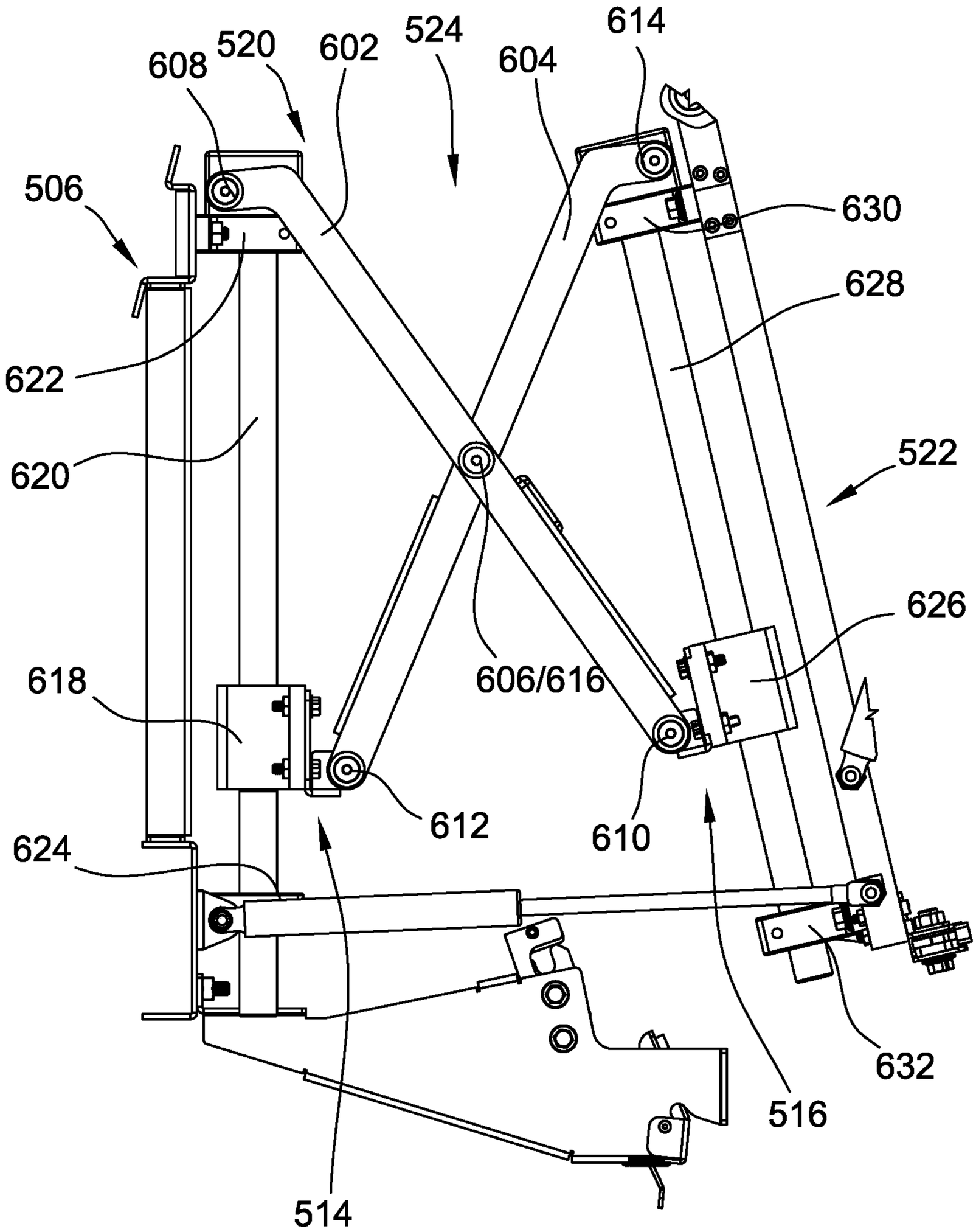

608
520
602
524
604
614
506
630
628
622
620
522
626
606/616
618
612
610
624
632
516
514

FIG. 10

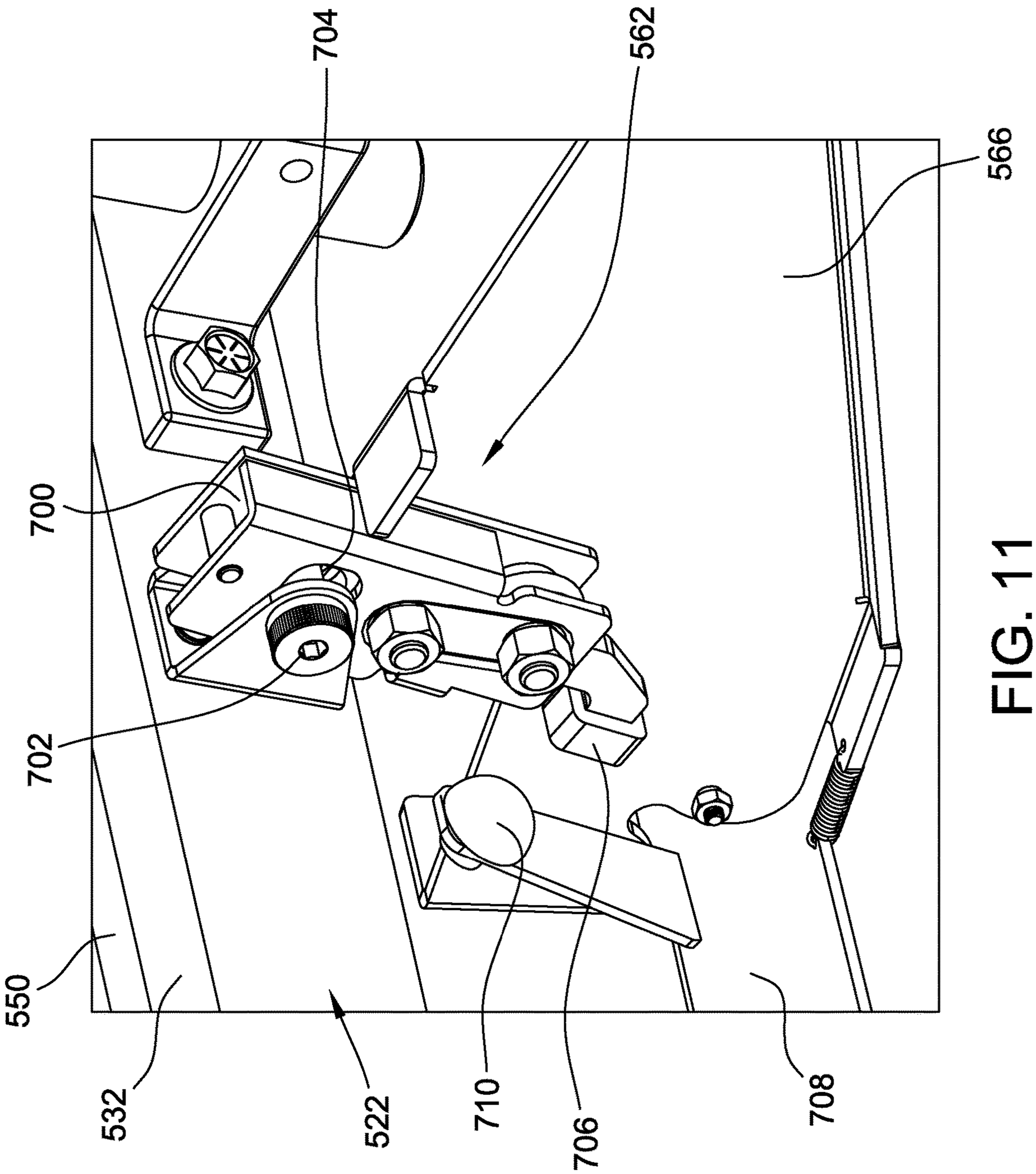


FIG. 11

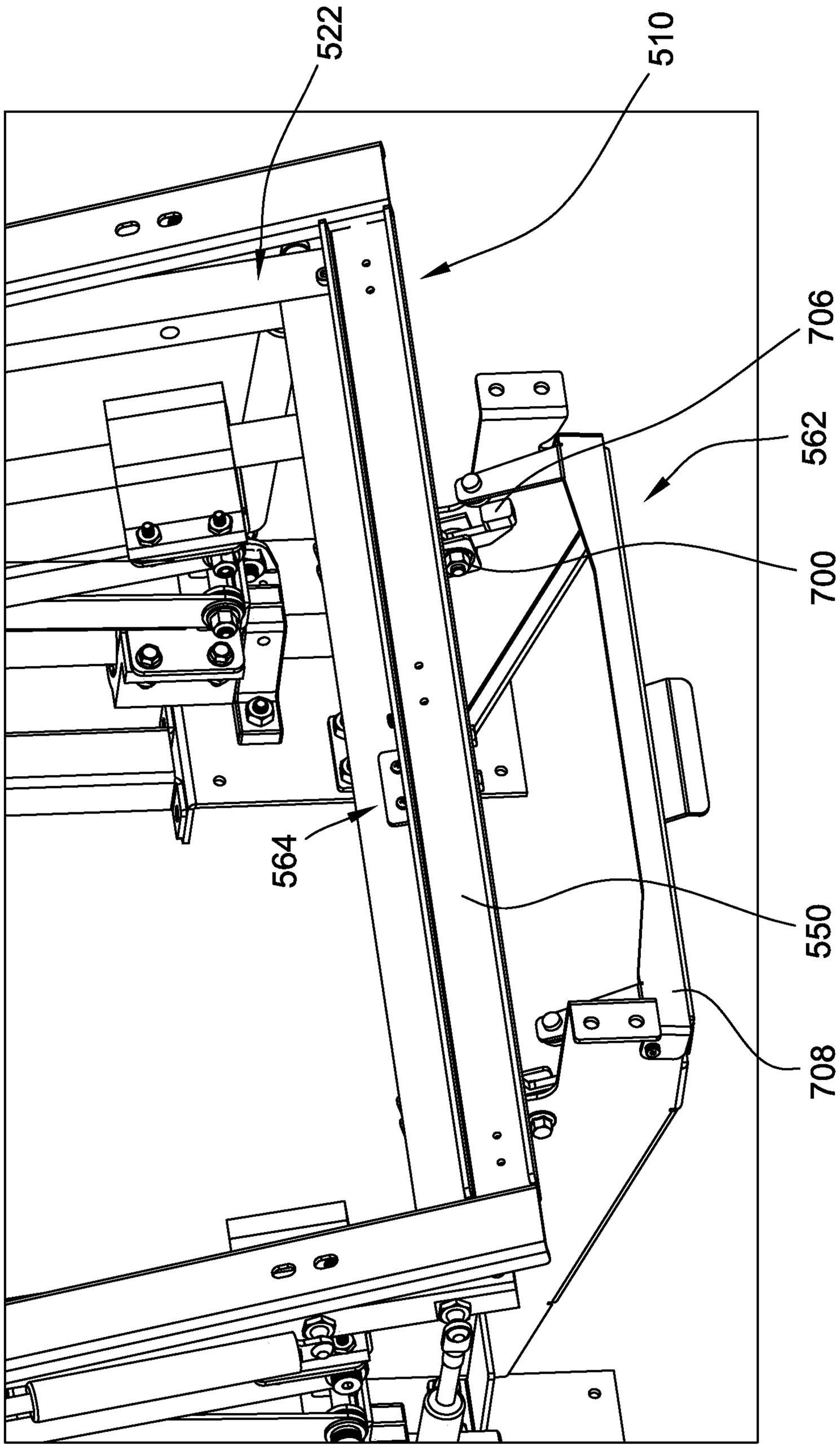


FIG. 12

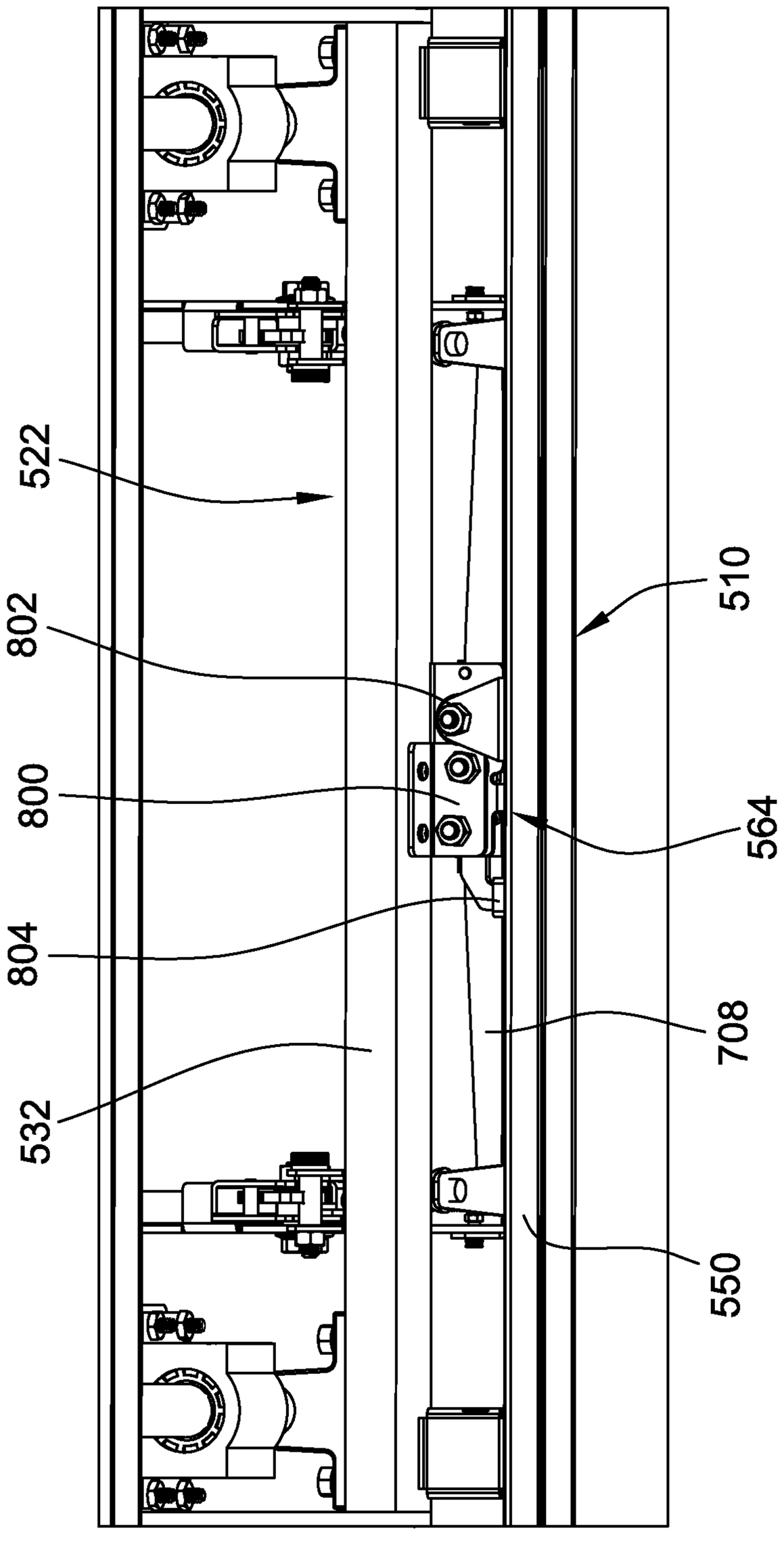


FIG. 13

ELECTRONIC GAMING MACHINE INCLUDING MONITOR ARTICULATION MECHANISM

TECHNICAL FIELD

The field of disclosure relates generally to electronic gaming, and more particularly, to electronic gaming machines including a monitor articulation mechanism.

BACKGROUND

Electronic gaming machines (EGMs), or gaming devices, provide a variety of wagering games such as, for example, and without limitation, slot games, video poker games, video blackjack games, roulette games, video bingo games, keno games, and other types of games that are frequently offered at casinos and other locations. Video-based games generally use one or more display screens to display gaming symbols to a player during game play.

Some gaming machines utilize two or more display screens or monitors, for example, to provide different display screens for different modes of game play (e.g., base game play and bonus or feature game play), or to create a larger display screen. In at least some such gaming machines, access to the gaming machine cabinet may be provided by rotating or otherwise moving one or more of the monitors from a first, closed position to a second, open position to provide access to an opening in the gaming machine cabinet. As the design of multiple-monitor gaming devices evolves, improved monitor articulation mechanisms are needed to allow monitors to be moved to provide access to the gaming machine cabinet, without interfering with or being obstructed by surrounding components of the gaming machine, such as adjacent monitors, panels, etc.

BRIEF DESCRIPTION

In one aspect, an electronic gaming machine includes a cabinet defining an internal compartment and an access opening that provides access to the internal compartment, a monitor positioned within the access opening, and an articulating support frame positioned within the internal compartment and operatively coupled to the monitor. The monitor is moveable by the articulating support frame along a first, linear path of motion from a first, closed position to a second, intermediate position, and along a second, arcuate path of motion from the second position to a third, open position.

In another aspect, a method includes providing an electronic gaming machine that includes a cabinet defining an internal compartment and an access opening, a monitor positioned within the access opening, and an articulating support frame positioned within the internal compartment and operatively coupled to the monitor. The method further includes moving the monitor, by the articulating support frame, along a first, linear path of motion from a first, closed position to a second, intermediate position, and moving the monitor, by the articulating support frame, along a second, arcuate path of motion from the second position to a third, open position in which the monitor permits access to the internal compartment through the access opening.

In yet another aspect, an articulating support frame for a monitor of an electronic gaming machine is provided. The articulating support frame includes a linear guide having a proximal end configured for fixedly coupling to a cabinet of the electronic gaming machine, and a distal end configured for linear movement towards and away from the proximal end. The articulating support frame further includes a monitor mounting frame pivotably coupled to the linear guide at the distal end thereof. The articulating support frame is configured to move the monitor along a first, linear path of motion from a first, closed position to a second, intermediate position, and along a second, arcuate path of motion from the second position to a third, open position.

BRIEF DESCRIPTION OF THE DRAWINGS

An example embodiment of the subject matter disclosed will now be described with reference to the accompanying drawings.

FIG. **1** is a schematic diagram of a plurality of EGMs networked with various gaming-related servers;

FIG. **2** is a block diagram showing various functional elements of an exemplary EGM;

FIG. **3** illustrates, in block diagram form, an embodiment of a game processing architecture that implements a game processing pipeline for the play of a game in accordance with some embodiments described herein;

FIG. **4** is a perspective view of an exemplary EGM including a first display monitor and a second display monitor;

FIG. **5** is a perspective view of an exemplary monitor articulation mechanism coupled to the first display monitor and positioned within an internal compartment of the EGM shown in FIG. **4**;

FIG. **6** is a side view of the monitor articulation mechanism and the first display monitor shown in FIG. **5**, where the first display monitor is shown in a first, closed position;

FIG. **7** is another side view of the monitor articulation mechanism and the first display monitor shown in FIG. **5**, where the first display monitor is shown in a second, intermediate position;

FIG. **8** is another side view of the monitor articulation mechanism and the first display monitor shown in FIG. **5**, where the first display monitor is shown in a third, open position;

FIG. **9** is a perspective view of the monitor articulation mechanism shown in FIG. **5**, illustrated in the third, open position;

FIG. **10** is a side view of a linear guide of the monitor articulation mechanism shown in FIG. **5**;

FIG. **11** is an enlarged perspective view of a linear motion latch of the monitor articulation mechanism shown in FIG. **5**

FIG. **12** is another perspective view of the monitor articulation mechanism shown in FIG. **5**, illustrating additional details of the linear motion latch shown in FIG. **11**; and

FIG. **13** is a top view of a portion of the monitor articulation mechanism shown in FIG. **5**, illustrating details of a rotational motion latch.

DETAILED DESCRIPTION

Embodiments of the present disclosure are directed to monitor articulation mechanisms and, in particular, articulating support frames for monitors of electronic gaming machines. Embodiments of the articulating support frames disclosed herein allow monitors of electronic gaming machines to be moved along a path of motion with multiple, discrete motion paths such that the monitor can be moved out of an access opening to provide access to an internal compartment of the electronic gaming machine, without

interfering with adjacent components of the electronic gaming machine (e.g., adjacent monitors, light bars, etc.). The articulating support frames of the present disclosure thereby allow monitors of various configurations and arrangements (including, for example, multiple curved monitors positioned adjacent one another) to be used as an access door or panel to access the internal compartment of the electronic gaming machine.

FIG. **1** illustrates several different models of EGMs which may be networked to various gaming related servers. Shown is a system **100** in a gaming environment including one or more server computers **102** (e.g., slot servers of a casino) that are in communication, via a communications network, with one or more gaming machines or devices **104**A-**104**X (EGMs, slots, video poker, bingo machines, etc.) that can implement one or more aspects of the present disclosure. The gaming devices **104**A-**104**X may alternatively be portable and/or remote gaming devices such as, but not limited to, a smart phone, a tablet, a laptop, or a game console. Gaming devices **104**A-**104**X utilize specialized software and/or hardware to form non-generic, particular machines or apparatuses that comply with regulatory requirements regarding devices used for wagering or games of chance that provide monetary awards.

Communication between the gaming devices **104**A-**104**X and the server computers **102**, and among the gaming devices **104**A-**104**X, may be direct or indirect using one or more communication protocols. As an example, gaming devices **104**A-**104**X and the server computers **102** can communicate over one or more communication networks, such as over the Internet through a web site maintained by a computer on a remote server or over an online data network including commercial online service providers, Internet service providers, private networks (e.g., local area networks and enterprise networks), and the like (e.g., wide area networks). The communication networks could allow gaming devices **104**A-**104**X to communicate with one another and/or the server computers **102** using a variety of communication-based technologies, such as radio frequency (RF) (e.g., wireless fidelity (WiFi®) and Bluetooth®), cable TV, satellite links and the like.

In some embodiments, server computers **102** may not be necessary and/or preferred. For example, in one or more embodiments, a stand-alone gaming device such as gaming device **104**A, gaming device **104**B or any of the other gaming devices **104**C-**104**X can implement one or more aspects of the present disclosure. However, it is typical to find multiple EGMs connected to networks implemented with one or more of the different server computers **102** described herein.

The server computers **102** may include a central determination gaming system server **106**, a ticket-in-ticket-out (TITO) system server **108**, a player tracking system server **110**, a progressive system server **112**, and/or a casino management system server **114**. Gaming devices **104**A-**104**X may include features to enable operation of any or all servers for use by the player and/or operator (e.g., the casino, resort, gaming establishment, tavern, pub, etc.). For example, game outcomes may be generated on a central determination gaming system server **106** and then transmitted over the network to any of a group of remote terminals or remote gaming devices **104**A-**104**X that utilize the game outcomes and display the results to the players.

Gaming device **104**A is often of a cabinet construction which may be aligned in rows or banks of similar devices for placement and operation on a casino floor. The gaming device **104**A often includes one or more access doors **154** which provide access to the interior of the cabinet. Access door **154** labelled on gaming device **104**A in FIG. **1** is a top door, although it should be understood that gaming device **104**A may include any suitable number and combination of access doors including, for example and without limitation, a main door, a top door, a drop door, a belly door, and/or a stacker door Gaming device **104**A typically includes a button area or button deck **120** accessible by a player that is configured with input switches or buttons **122**, an access channel for a bill validator **124**, and/or an access channel for a ticket-out printer **126**.

In FIG. **1**, gaming device **104**A is shown as a Relm XL™ model gaming device manufactured by Aristocrat® Technologies, Inc. As shown, gaming device **104**A is a reel machine having a gaming display area **118** comprising a number (typically 3 or 5) of mechanical reels **130** with various symbols displayed on them. The reels **130** are independently spun and stopped to show a set of symbols within the gaming display area **118** which may be used to determine an outcome to the game.

In many configurations, the gaming machine **104**A may have a main display **128** (e.g., video display monitor) mounted to, or above, the gaming display area **118**. The main display **128** can be a high-resolution LCD, plasma, LED, or OLED panel which may be flat or curved as shown, a cathode ray tube, or other conventional electronically controlled video monitor.

In some embodiments, the bill validator **124** may also function as a "ticket-in" reader that allows the player to use a casino issued credit ticket to load credits onto the gaming device **104**A (e.g., in a cashless ticket ("TITO") system). In such cashless embodiments, the gaming device **104**A may also include a "ticket-out" printer **126** for outputting a credit ticket when a "cash out" button is pressed. Cashless TITO systems are used to generate and track unique bar-codes or other indicators printed on tickets to allow players to avoid the use of bills and coins by loading credits using a ticket reader and cashing out credits using a ticket-out printer **126** on the gaming device **104**A. The gaming machine **104**A can have hardware meters for purposes including ensuring regulatory compliance and monitoring the player credit balance. In addition, there can be additional meters that record the total amount of money wagered on the gaming machine, total amount of money deposited, total amount of money withdrawn, total amount of winnings on gaming device **104**A.

In some embodiments, a player tracking card reader **144**, a transceiver for wireless communication with a mobile device (e.g., a player's smartphone), a keypad **146**, and/or an illuminated display **148** for reading, receiving, entering, and/or displaying player tracking information is provided in EGM **104**A. In such embodiments, a game controller within the gaming device **104**A can communicate with the player tracking system server **110** to send and receive player tracking information.

Gaming device **104**A may also include a bonus topper wheel **134**. When bonus play is triggered (e.g., by a player achieving a particular outcome or set of outcomes in the primary game), bonus topper wheel **134** is operative to spin and stop with indicator arrow **136** indicating the outcome of the bonus game. Bonus topper wheel **134** is typically used to play a bonus game, but it could also be incorporated into play of the base or primary game.

A candle **138** may be mounted on the top of gaming device **104**A and may be activated by a player (e.g., using a switch or one of buttons **122**) to indicate to operations staff that gaming device **104**A has experienced a malfunction or

the player requires service. The candle **138** is also often used to indicate a jackpot has been won and to alert staff that a hand payout of an award may be needed.

There may also be one or more information panels **152** which may be a back-lit, silkscreened glass panel with lettering to indicate general game information including, for example, a game denomination (e.g., $0.25 or $1), pay lines, pay tables, and/or various game related graphics. In some embodiments, the information panel(s) **152** may be implemented as an additional video display.

Gaming devices **104**A have traditionally also included a handle **132** typically mounted to the side of main cabinet **116** which may be used to initiate game play.

Many or all the above described components can be controlled by circuitry (e.g., a gaming controller) housed inside the main cabinet **116** of the gaming device **104**A, the details of which are shown in FIG. **2**.

An alternative example gaming device **104**B illustrated in FIG. **1** is the Arc™ model gaming device manufactured by Aristocrat® Technologies, Inc. Note that where possible, reference numerals identifying similar features of the gaming device **104**A embodiment are also identified in the gaming device **104**B embodiment using the same reference numbers. Gaming device **104**B does not include physical reels and instead shows game play functions on main display **128**. An optional topper screen **140** may be used as a secondary game display for bonus play, to show game features or attraction activities while a game is not in play, or any other information or media desired by the game designer or operator. In some embodiments, topper screen **140** may also or alternatively be used to display progressive jackpot prizes available to a player during play of gaming device **104**B.

Example gaming device **104**B includes a main cabinet **116** including an access door **154** which opens to provide access to the interior of the gaming device **104**B. The access door **154** is typically used by service personnel to refill the ticket-out printer **126** and collect bills and tickets inserted into the bill validator **124**. The access door **154** may also be accessed to reset the machine, verify and/or upgrade the software, and for general maintenance operations.

Another example gaming device **104**C shown is the Helix™ model gaming device manufactured by Aristocrat® Technologies, Inc. Gaming device **104**C includes a main display **128**A that is in a landscape orientation. Although not illustrated by the front view provided, the landscape display **128**A may have a curvature radius from top to bottom, or alternatively from side to side. In some embodiments, display **128**A is a flat panel display. Main display **128**A is typically used for primary game play while secondary display **128**B is typically used for bonus game play, to show game features or attraction activities while the game is not in play or any other information or media desired by the game designer or operator. In some embodiments, example gaming device **104**C may also include speakers **142** to output various audio such as game sound, background music, etc.

Many different types of games, including mechanical slot games, video slot games, video poker, video black jack, video pachinko, keno, bingo, and lottery, may be provided with or implemented within the depicted gaming devices **104**A-**104**C and other similar gaming devices. Each gaming device may also be operable to provide many different games. Games may be differentiated according to themes, sounds, graphics, type of game (e.g., slot game vs. card game vs. game with aspects of skill), denomination, number of paylines, maximum jackpot, progressive or non-progressive, bonus games, and may be deployed for operation in Class 2 or Class 3, etc.

FIG. **2** is a block diagram depicting exemplary internal electronic components of a gaming device **200** connected to various external systems. All or parts of the example gaming device **200** shown could be used to implement any one of the example gaming devices **104**A-X depicted in FIG. **1**. As shown in FIG. **2**, gaming device **200** includes a topper display **216** or another form of a top box (e.g., a topper wheel, a topper screen, etc.) that sits above cabinet **218**. Cabinet **218** or topper display **216** may also house a number of other components which may be used to add features to a game being played on gaming device **200**, including speakers **220**, a ticket printer **222** which prints bar-coded tickets or other media or mechanisms for storing or indicating a player's credit value, a ticket reader **224** which reads bar-coded tickets or other media or mechanisms for storing or indicating a player's credit value, and a player tracking interface **232**. Player tracking interface **232** may include a keypad **226** for entering information, a player tracking display **228** for displaying information (e.g., an illuminated or video display), a card reader **230** for receiving data and/or communicating information to and from media or a device such as a smart phone enabling player tracking. FIG. **2** also depicts utilizing a ticket printer **222** to print tickets for a TITO system server **108**. Gaming device **200** may further include a bill validator **234**, player-input buttons **236** for player input, cabinet security sensors **238** to detect unauthorized opening of the cabinet **218**, a primary game display **240**, and a secondary game display **242**, each coupled to and operable under the control of game controller **202**.

The games available for play on the gaming device **200** are controlled by a game controller **202** that includes one or more processors **204**. Processor **204** represents a general-purpose processor, a specialized processor intended to perform certain functional tasks, or a combination thereof. As an example, processor **204** can be a central processing unit (CPU) that has one or more multi-core processing units and memory mediums (e.g., cache memory) that function as buffers and/or temporary storage for data. Alternatively, processor **204** can be a specialized processor, such as an application specific integrated circuit (ASIC), graphics processing unit (GPU), field-programmable gate array (FPGA), digital signal processor (DSP), or another type of hardware accelerator. In another example, processor **204** is a system on chip (SoC) that combines and integrates one or more general-purpose processors and/or one or more specialized processors. Although FIG. **2** illustrates that game controller **202** includes a single processor **204**, game controller **202** is not limited to this representation and instead can include multiple processors **204** (e.g., two or more processors).

FIG. **2** illustrates that processor **204** is operatively coupled to memory **208**. Memory **208** is defined herein as including volatile and nonvolatile memory and other types of non-transitory data storage components. Volatile memory is memory that do not retain data values upon loss of power. Nonvolatile memory is memory that do retain data upon a loss of power. Examples of memory **208** include random access memory (RAM), read-only memory (ROM), hard disk drives, solid-state drives, USB flash drives, memory cards accessed via a memory card reader, floppy disks accessed via an associated floppy disk drive, optical discs accessed via an optical disc drive, magnetic tapes accessed via an appropriate tape drive, and/or other memory components, or a combination of any two or more of these memory components. In addition, examples of RAM include static

random access memory (SRAM), dynamic random access memory (DRAM), magnetic random access memory (MRAM), and other such devices. Examples of ROM include a programmable read-only memory (PROM), an erasable programmable read-only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM), or other like memory device. Even though FIG. **2** illustrates that game controller **202** includes a single memory **208**, game controller **202** could include multiple memories **208** for storing program instructions and/or data.

Memory **208** can store one or more game programs **206** that provide program instructions and/or data for carrying out various embodiments (e.g., game mechanics) described herein. Stated another way, game program **206** represents an executable program stored in any portion or component of memory **208**. In one or more embodiments, game program **206** is embodied in the form of source code that includes human-readable statements written in a programming language or machine code that contains numerical instructions recognizable by a suitable execution system, such as a processor **204** in a game controller or other system. Examples of executable programs include: (1) a compiled program that can be translated into machine code in a format that can be loaded into a random access portion of memory **208** and run by processor **204**; (2) source code that may be expressed in proper format such as object code that is capable of being loaded into a random access portion of memory **208** and executed by processor **204**; and (3) source code that may be interpreted by another executable program to generate instructions in a random access portion of memory **208** to be executed by processor **204**.

Alternatively, game programs **206** can be setup to generate one or more game instances based on instructions and/or data that gaming device **200** exchange with one or more remote gaming devices, such as a central determination gaming system server **106** (not shown in FIG. **2** but shown in FIG. **1**). For purpose of this disclosure, the term "game instance" refers to a play or a round of a game that gaming device **200** presents (e.g., via a user interface (UI)) to a player. The game instance is communicated to gaming device **200** via the network **214** and then displayed on gaming device **200**. For example, gaming device **200** may execute game program **206** as video streaming software that allows the game to be displayed on gaming device **200**. When a game is stored on gaming device **200**, it may be loaded from memory **208** (e.g., from a read only memory (ROM)) or from the central determination gaming system server **106** to memory **208**.

The game controller **202**, including the processor **204** and the memory **208**, along with other components of the gaming device **200**, are housed within an internal compartment **244** defined by the cabinet **218**. Although only a single internal compartment **244** is shown in FIG. **2**, it should be understood that the gaming device **200** may include more than a single internal compartment **244**, and that other components than those shown in FIG. **2** may be housed within the internal compartments **244** of the gaming device **200**. The internal compartment **244** may be accessible via an access door of cabinet **218** (e.g., access door **154**, shown in FIG. **1**).

Gaming devices, such as gaming device **200**, are highly regulated to ensure fairness and, in many cases, gaming device **200** is operable to award monetary awards (e.g., typically dispensed in the form of a redeemable voucher). Therefore, to satisfy security and regulatory requirements in a gaming environment, hardware and software architectures are implemented in gaming devices **200** that differ significantly from those of general-purpose computers. Adapting general purpose computers to function as gaming devices **200** is not simple or straightforward because of: (1) the regulatory requirements for gaming devices **200**, (2) the harsh environment in which gaming devices **200** operate, (3) security requirements, (4) fault tolerance requirements, and (5) the requirement for additional special purpose componentry enabling functionality of an EGM. These differences require substantial engineering effort with respect to game design implementation, game mechanics, hardware components, and software.

One regulatory requirement for games running on gaming device **200** generally involves complying with a certain level of randomness. Typically, gaming jurisdictions mandate that gaming devices **200** satisfy a minimum level of randomness without specifying how a gaming device **200** should achieve this level of randomness. To comply, FIG. **2** illustrates that gaming device **200** includes an RNG **212** that utilizes hardware and/or software to generate RNG outcomes that lack any pattern. The RNG operations are often specialized and non-generic in order to comply with regulatory and gaming requirements. For example, in a reel game, game program **206** can initiate multiple RNG calls to RNG **212** to generate RNG outcomes, where each RNG call and RNG outcome corresponds to an outcome for a reel. In another example, gaming device **200** can be a Class II gaming device where RNG **212** generates RNG outcomes for creating Bingo cards. In one or more embodiments, RNG **212** could be one of a set of RNGs operating on gaming device **200**. Game developers could vary the degree of true randomness for each RNG (e.g., pseudorandom) and utilize specific RNGs depending on game requirements.

Another regulatory requirement for running games on gaming device **200** includes ensuring a certain level of RTP. Similar to the randomness requirement discussed above, numerous gaming jurisdictions also mandate that gaming device **200** provides a minimum level of RTP (e.g., RTP of at least 75%). FIG. **2** illustrates that gaming device **200** includes an RNG conversion engine **210** that translates the RNG outcome from RNG **212** to a game outcome presented to a player. To meet a designated RTP, a game developer can setup the RNG conversion engine **210** to utilize one or more lookup tables to translate the RNG outcome to a symbol element, stop position on a reel strip layout, and/or randomly chosen aspect of a game feature. As an example, the lookup tables can regulate a prize payout amount for each RNG outcome and how often the gaming device **200** pays out the prize payout amounts. The RNG conversion engine **210** could utilize one lookup table to map the RNG outcome to a game outcome displayed to a player and a second lookup table as a pay table for determining the prize payout amount for each game outcome. The mapping between the RNG outcome to the game outcome controls the frequency in hitting certain prize payout amounts.

FIG. **2** also depicts that gaming device **200** is connected over network **214** to player tracking system server **110**. Player tracking system server **110** may be, for example, an OASIS® system manufactured by Aristocrat® Technologies, Inc. Player tracking system server **110** is used to track play (e.g. amount wagered, games played, time of play and/or other quantitative or qualitative measures) for individual players so that an operator may reward players in a loyalty program. The player may use the player tracking interface **232** to access his/her account information, activate free play, and/or request various information. Player tracking or loyalty programs seek to reward players for their play and help build brand loyalty to the gaming establishment.

The rewards typically correspond to the player's level of patronage (e.g., to the player's playing frequency and/or total amount of game plays at a given casino). Player tracking rewards may be complimentary and/or discounted meals, lodging, entertainment and/or additional play. Player tracking information may be combined with other information that is now readily obtainable by a casino management system.

When a player wishes to play the gaming device **200**, he/she can insert cash or a ticket voucher through a coin acceptor (not shown) or bill validator **234** to establish a credit balance on the gamine machine. The credit balance is used by the player to place wagers on instances of the game and to receive credit awards based on the outcome of winning instances. The credit balance is decreased by the amount of each wager and increased upon a win. The player can add additional credits to the balance at any time. The player may also optionally insert a loyalty club card into the card reader **230**. During the game, the player views with one or more UIs, the game outcome on one or more of the primary game display **240** and secondary game display **242**. Other game and prize information may also be displayed.

For each game instance, a player may make selections, which may affect play of the game. For example, the player may vary the total amount wagered by selecting the amount bet per line and the number of lines played. In many games, the player is asked to initiate or select options during course of game play (such as spinning a wheel to begin a bonus round or select various items during a feature game). The player may make these selections using the player-input buttons **236**, the primary game display **240** which may be a touch screen, or using some other device which enables a player to input information into the gaming device **200**.

During certain game events, the gaming device **200** may display visual and auditory effects that can be perceived by the player. These effects add to the excitement of a game, which makes a player more likely to enjoy the playing experience. Auditory effects include various sounds that are projected by the speakers **220**. Visual effects include flashing lights, strobing lights or other patterns displayed from lights on the gaming device **200** or from lights behind the information panel **152** (FIG. **1**).

When the player is done, he/she cashes out the credit balance (typically by pressing a cash out button to receive a ticket from the ticket printer **222**). The ticket may be "cashed-in" for money or inserted into another machine to establish a credit balance for play.

Although FIGS. **1** and **2** illustrates specific embodiments of a gaming device (e.g., gaming devices **104**A-**104**X and **200**), the disclosure is not limited to those embodiments shown in FIGS. **1** and **2**. For example, not all gaming devices suitable for implementing embodiments of the present disclosure necessarily include top wheels, top boxes, information panels, cashless ticket systems, and/or player tracking systems. Further, some suitable gaming devices have only a single game display that includes only a mechanical set of reels and/or a video display, while others are designed for bar counters or table tops and have displays that face upwards. Additionally, or alternatively, gaming devices **104**A-**104**X and **200** can include credit transceivers that wirelessly communicate (e.g., Bluetooth or other near-field communication technology) with one or more mobile devices to perform credit transactions. As an example, bill validator **234** could contain or be coupled to the credit transceiver that output credits from and/or load credits onto the gaming device **104**A by communicating with a player's smartphone (e.g., a digital wallet interface). Gaming devices **104**A-**104**X and **200** may also include other processors that are not separately shown. Using FIG. **2** as an example, gaming device **200** could include display controllers (not shown in FIG. **2**) configured to receive video input signals or instructions to display images on game displays **240** and **242**. Alternatively, such display controllers may be integrated into the game controller **202**. The use and discussion of FIGS. **1** and **2** are examples to facilitate ease of description and explanation.

FIG. **3** illustrates, in block diagram form, an embodiment of a game processing architecture **300** that implements a game processing pipeline for the play of a game in accordance with various embodiments described herein. As shown in FIG. **3**, the gaming processing pipeline starts with having a UI system **302** receive one or more player inputs for the game instance. Based on the player input(s), the UI system **302** generates and sends one or more RNG calls to a game processing backend system **314**. Game processing backend system **314** then processes the RNG calls with RNG engine **316** to generate one or more RNG outcomes. The RNG outcomes are then sent to the RNG conversion engine **320** to generate one or more game outcomes for the UI system **302** to display to a player. The game processing architecture **300** can implement the game processing pipeline using a gaming device, such as gaming devices **104**A-**104**X and **200** shown in FIGS. **1** and **2**, respectively. Alternatively, portions of the gaming processing architecture **300** can implement the game processing pipeline using a gaming device and one or more remote gaming devices, such as central determination gaming system server **106** shown in FIG. **1**.

The UI system **302** includes one or more UIs that a player can interact with. The UI system **302** could include one or more game play UIs **304**, one or more bonus game play UIs **308**, and one or more multiplayer UIs **312**, where each UI type includes one or more mechanical UIs and/or graphical UIs (GUIs). In other words, game play UI **304**, bonus game play UI **308**, and the multiplayer UI **312** may utilize a variety of UI elements, such as mechanical UI elements (e.g., physical "spin" button or mechanical reels) and/or GUI elements (e.g., virtual reels shown on a video display or a virtual button deck) to receive player inputs and/or present game play to a player. Using FIG. **3** as an example, the different UI elements are shown as game play UI elements **306**A-**306**N and bonus game play UI elements **310**A-**310**N.

The game play UI **304** represents a UI that a player typically interfaces with for a base game. During a game instance of a base game, the game play UI elements **306**A-**306**N (e.g., GUI elements depicting one or more virtual reels) are shown and/or made available to a user. In a subsequent game instance, the UI system **302** could transition out of the base game to one or more bonus games. The bonus game play UI **308** represents a UI that utilizes bonus game play UI elements **310**A-**310**N for a player to interact with and/or view during a bonus game. In one or more embodiments, at least some of the game play UI element **306**A-**306**N are similar to the bonus game play UI elements **310**A-**310**N. In other embodiments, the game play UI element **306**A-**306**N can differ from to the bonus game play UI elements **310**A-**310**N.

FIG. **3** also illustrates that UI system **302** could include a multiplayer UI **312** purposed for game play that differ or is separate from the typical base game. For example, multiplayer UI **302** could be set up to receive player inputs and/or presents game play information relating to a tournament mode. When a gaming device transitions from a primary game mode that presents the base game to a tournament

mode, a single gaming device is linked and synchronized to other gaming devices to generate a tournament outcome. For example, multiple RNG engines **316** corresponding to each gaming device could be collectively linked to determine a tournament outcome. To enhance a player's gaming experience, tournament mode can modify and synchronize sound, music, reel spin speed, and/or other operations of the gaming devices according to the tournament game play. After tournament game play ends, operators can switch back the gaming device from tournament mode to a primary game mode to present the base game. Although FIG. **3** does not explicitly depict that multiplayer UI **312** includes UI elements, multiplayer UI **312** could also include one or more multiplayer UI elements.

Based on the player inputs, the UI system **302** could generate RNG calls to a game processing backend system **314**. As an example, the UI system **302** could use one or more application programming interfaces (APIs) to generate the RNG calls. To process the RNG calls, the RNG engine **316** could utilize gaming RNG **318** and/or non-gaming RNGs **319**A-**319**N. Gaming RNG **318** corresponds to RNG **212** shown in FIG. **2**. As previously discussed with reference to FIG. **2**, gaming RNG **318** often performs specialized and non-generic operations that comply with regulatory and/or game requirements. For example, because of regulation requirements, gaming RNG **318** could be a cryptographic random or pseudorandom number generator (PRNG) (e.g., Fortuna PRNG) that securely produces random numbers for one or more game features. To generate random numbers, gaming RNG **318** could collect random data from various sources of entropy, such as from an operating system (OS). Alternatively, non-gaming RNGs **319**A-**319**N may not be cryptographically secure and/or be computationally less expensive. Non-gaming RNGs **319**A-**319**N can thus be used to generate outcomes for non-gaming purposes. As an example, non-gaming RNGs **319**A-**319**N can generate random numbers for such as generating random messages that appear on the gaming device. The RNG conversion engine **320** processes each RNG outcome from RNG engine **316** and converts the RNG outcome to a UI outcome that is feedback to the UI system **302**. With reference to FIG. **2**, RNG conversion engine **320** corresponds to RNG conversion engine **210** used for game play. As previously described, RNG conversion engine **320** translates the RNG outcome from the RNG **212** to a game outcome presented to a player. RNG conversion engine **320** utilizes one or more lookup tables **322**A-**322**N to regulate a prize payout amount for each RNG outcome and how often the gaming device pays out the derived prize payout amounts. In one example, the RNG conversion engine **320** could utilize one lookup table to map the RNG outcome to a game outcome displayed to a player and a second lookup table as a pay table for determining the prize payout amount for each game outcome. In this example, the mapping between the RNG outcome to the game outcome controls the frequency in hitting certain prize payout amounts. Different lookup tables could be utilized depending on the different game modes, for example, a base game versus a bonus game.

After generating the UI outcome, the game processing backend system **314** sends the UI outcome to the UI system **302**. Examples of UI outcomes are symbols to display on a video reel or reel stops for a mechanical reel. In one example, if the UI outcome is for a base game, the UI system **302** updates one or more game play UI elements **306**A-**306**N, such as symbols, for the game play UI **304**. In another example, if the UI outcome is for a bonus game, the UI system could update one or more bonus game play UI elements **310**A-**310**N (e.g., symbols) for the bonus game play UI **308**. In response to the updating the appropriate UI, the player may subsequently provide additional player inputs to initiate a subsequent game instance that progresses through the game processing pipeline.

FIG. **4** is a perspective view of another exemplary gaming machine **400**, shown as an EDGE X™ model gaming machine manufactured by Aristocrat® Technologies, Inc. All or parts of the example gaming devices **104**A-X, **200** shown in FIGS. **1** and **2**, respectively, could be implemented in gaming machine **400**. In the exemplary embodiment, gaming machine **400** includes a cabinet **402** that houses electronic components or circuitry of gaming machine **400** (e.g., electronic components shown in FIG. **2**), a first display monitor **404**, and a second display monitor **406**.

Each of first and second display monitors **404**, **406** includes a display screen **408** and a housing **410** that houses or encloses electronic components of the display monitor. Each of first and second display monitors **404**, **406** can be a high-resolution LCD, plasma, LED, or OLED panel which may be flat or curved as shown, a cathode ray tube, or other conventional electronically controlled video monitor. First and second display monitors **404**, **406** also include respective top edges **412**, bottom edges **414**, and first and second side edges **416**, **418** extending between top edge **412** and bottom **414**. In the illustrated embodiment, each of the first display monitor **404** and the second display monitor **406** includes a curved display screen **408** that has a curvature radius from top edge **412** to bottom edge **414**.

First and second display monitors **404**, **406** are coupled to cabinet **402** in a vertically-stacked configuration in which the second display monitor **406** is positioned above and adjacent to first display monitor **404** such that bottom edge **414** of second display monitor **406** adjoins top edge **412** of first display monitor **404**. First and second display monitors **404**, **406** thereby cooperatively form a combined curved display screen, and adjoin one another along an edge (e.g., top edge **412** of first display monitor **404** and bottom edge of second display monitor **406**) that intersects the curved display screen. In other embodiments, first display monitor **404** may be positioned above second display monitor **406**. In yet other embodiments, first and second display monitors **404**, **406** may be coupled to cabinet **402** in a horizontal configuration such that first and second display monitors **404**, **406** adjoin one another along a vertical edge (e.g., first and second side edges **416**, **418**).

In the exemplary embodiment, first display monitor **404** is a main or primary display monitor typically used for primary game play, and second display monitor **406** is a secondary display monitor typically used for bonus game play, to show game features or attraction activities while the game is not in play or any other information or media desired by the game designer or operator. In other embodiments, second display monitor **406** may be used as the main or primary display monitor, and first display monitor **404** may be used as the secondary display monitor. In yet other embodiments, first display monitor **404** and second display monitor **406** may be used in combination with one another to display GUIs and graphics for both primary game play and bonus game play.

In the exemplary embodiment, gaming machine **400** also includes vertical light bars **420** positioned on opposite sides of first and second display monitors **404**, **406**. Gaming machine **400** may include other components of gaming devices **104**A-**104**X and **200** shown in FIGS. **1** and **2**,

respectively. For example, gaming machine **400** includes a button area or button deck **422** that is configured with input switches or buttons **424**.

In accordance with the present disclosure, one or both of first and second display monitors **404**, **406** may be operable as an access door (e.g., access door **154**) that provides access to an internal compartment **426** defined by cabinet **402**. A portion of the first display monitor **404** is cut away in FIG. **4** to illustrate a portion of the internal compartment **426**. In particular, one or both of first and second display monitors **404**, **406** may be moveable from their respective closed positions shown in FIG. **4** to respective open positions in which first and second display monitors **404**, **406** enable access to the internal compartment **426** through one or more access openings.

In the exemplary embodiment, first display monitor **404** is a moveable monitor, and is positioned within an access opening **428** of gaming machine **400**. The access opening **428** is sized and shaped complementary to first display monitor **404** such that, when first display monitor **404** is in a closed position (shown in FIG. **4**), first display monitor completely occludes access opening **428**, and prevents access to internal compartment **426**. In the illustrated embodiment, access opening **428** is defined, at least in part, by bottom edge **414** of second display monitor **406** and light bars **420**. As described further herein, first display monitor **404** is operatively coupled to a monitor articulation mechanism that enables first display monitor **404** to be moved along a first, linear path of motion and, subsequently, along a second, arcuate path of motion such that first display monitor **404** can be moved out of access opening **428** without interfering with or being obstructed by surrounding components of gaming machine **400** (e.g., second display monitor **406** and light bars **420**).

FIG. **5** is a perspective view of a monitor articulation mechanism, illustrated in the form of an articulating support frame **500**, coupled to first display monitor **404**. FIG. **6** is a side view of articulating support frame **500** coupled to first display monitor **404**, and FIGS. **7** and **8** illustrate articulating support frame **500** moving first display monitor **404** along a first, linear path of motion (indicated by arrow **502** in FIG. **7**) from a first, closed position (shown in FIGS. **4-6**) to a second, intermediate position (shown in FIG. **7**), and along a second, arcuate path of motion (indicated by arrow **504** in FIG. **8**) from the second position to a third, open position (shown in FIG. **8**) in which first display monitor **404** permits access to internal compartment **426** through access opening **428**.

Articulating support frame **500** is positioned within internal compartment **426** of gaming machine **400**, and is operatively coupled to first display monitor **404**. In the exemplary embodiment, articulating support frame **500** includes a mounting frame assembly **506** for mounting articulating support frame **500** to cabinet **402**, a linear guide **508** for moving first display monitor **404** along first, linear path of motion **502**, and a monitor mounting frame **510**.

With additional reference to FIG. **9**, mounting frame assembly **506** includes a plurality of mounting brackets **512** that are fixedly coupled to cabinet **402**. Mounting brackets **512** are tubular U-shaped brackets in the illustrated embodiment, although it should be understood that mounting brackets **512** may have any other suitable construction that enables articulating support frame **500** to function as described herein.

Articulating support frame **500** is fixedly coupled to cabinet **402** by mounting frame assembly **506**. In particular, linear guide **508** has a first, proximal end **514** fixedly coupled to the cabinet **402** by mounting frame assembly **506**. Linear guide **508** also has a second, distal end **516** configured for linear movement towards and away from proximal end **514** along a linear path of motion. As described further herein, linear guide **508** is moveable between a first, retracted position (shown in FIGS. **5** and **6**) to a second, extended position (shown in FIG. **7**) in which distal end **516** is moved linearly away from proximal end **514**.

The terms proximal and distal when used with reference to articulating support frame **500** refer to the relative location or position of elements with respect to the fixed or proximal end of articulating support frame **500** (i.e., at mounting frame assembly **506**) and the moving or distal end of articulating support frame **500**. For example, "proximal" may refer to a location or position of an element closer to the fixed end of articulating support frame **500**, whereas "distal" may refer to a location or position of an element that is further from the fixed end of articulating support frame **500** and closer to the moveable end of articulating support frame **500**.

Monitor mounting frame **510** is pivotably coupled to linear guide **508** at distal end **516** thereof, and is configured to rotate about a pivot axis **518** at which monitor mounting frame **510** is pivotably coupled to linear guide **508**. Monitor mounting frame **510** is also configured to move linearly as linear guide **508** moves between the retracted and extended positions. First display monitor **404** is coupled to the monitor mounting frame **510**, and is configured to move linearly and arcuately with monitor mounting frame **510**. In other words, monitor mounting frame **510** moves along first, linear path of motion **502** from the first, closed position (shown in FIGS. **4-6**) to the second, intermediate position (shown in FIG. **7**), and along second, arcuate path of motion **504** from the second position to the third, open position (shown in FIG. **8**).

As shown in FIG. **9**, in the exemplary embodiment, linear guide **508** includes a scissor support frame **520** and a sub-frame **522** coupled at distal end **516** of linear guide **508**. Scissor support frame **520** is operable to move sub-frame **522** along first, linear path of motion **502** as scissor support frame **520** moves from the retracted position (shown in FIGS. **5** and **6**) to the extended position (shown in FIGS. **7-9**).

Scissor support frame **520** includes a plurality of cross-link assemblies **524**. With additional reference to FIG. **10**, each cross-link assembly **524** includes first and second frame members **602**, **604** pivotably coupled to one another at a pivot point **606**. Each first frame member **602** extends from a first, proximal end **608**, to a second, distal end **610**. Similarly, each second frame member **604** extends from a first, proximal end **612**, to a second, distal end **614**. Each first frame member **602** is pivotably coupled to a respective one of the second frame members **604** by a pivot pin **616** at a location in between the respective proximal and distal ends of each first frame member **602** and second frame member **604** such that the first and second frame members **602**, **604** can rotate relative to one another.

First end **612** of each second frame member **604** is pivotably coupled to a respective first linear slider bearing **618** at proximal end **514** of linear guide **508**. Each first linear slider bearing **618** is slidably coupled to a first, proximal shaft or rod **620** at proximal end **514** of linear guide **508**, which is fixedly coupled to mounting frame assembly **506** by first and second proximal shaft supports **622**, **624**. As shown, for example, in FIG. **7**, first linear slider bearing **618** allows first end **612** of each second frame member **604** to move linearly in a direction parallel to first shaft **620** as

scissor support frame **520** moves between the retracted position and the extended position.

First end **608** of each first frame member **602** is pivotably coupled to one of first proximal shaft supports **622** at proximal end **514** of linear guide **508**. Second end **610** of each first frame member **602** is pivotably coupled to a respective second linear slider bearing **626** at distal end **516** of linear guide **508**. Each second linear slider bearing **626** is slidably coupled to a second, distal shaft or rod **628** at distal end **516** of linear guide **508**, which is coupled to sub-frame **522** by first and second distal shaft supports **630**, **632**. As shown, for example, in FIG. **7**, second linear slider bearing **626** allows second end **610** of each first frame member **602** to move linearly in a direction parallel to second shaft **628** as scissor support frame **520** moves between the retracted position and the extended position.

Second end **614** of each second frame member **604** is pivotably coupled to one of first distal shaft supports **630** at distal end **516** of linear guide **508** such that second frame member **604** may rotate relative to first distal shaft support **630** as scissor support frame **520** moves between the retracted position and the extended position.

Referring again to FIG. **9**, sub-frame **522** is coupled to each of the plurality of cross-link assemblies **524** at distal end **516** of linear guide **508**, and is configured to move linearly along first path of motion **502** when linear guide **508** moves from the retracted position to the extended position. For example, when a distal force is applied to first display monitor **404** (e.g., by an operator pulling on first display monitor **404**), rotation of the first and second frame members **602**, **604** of each cross-link assembly **524** about pivot point **606** permits linear motion of sub-frame **522**, thereby allowing first display monitor **404** to move along first path of motion **502**.

In the exemplary embodiment, sub-frame **522** has a substantially rectangular configuration, and includes a first side member **526**, a second side member **528**, and first and second cross-members **530**, **532** extending from first side member **526** to second side member **528**. Sub-frame **522** is fixedly coupled to first and second distal shaft supports **630**, **632** of each cross-link assembly **524** such that sub-frame **522** moves with first and second distal shaft supports **630**, **632** as linear guide **508** moves from the retracted position to the extended position. In the exemplary embodiment, first distal shaft supports **630** are coupled to first cross member **530**, and second distal shaft supports **632** are coupled to second cross member **532**. In other embodiments, first and second distal shaft supports **630**, **632** may be coupled to any suitable portion of sub-frame **522** that enables articulating support frame to function as described herein.

Although linear guide **508** is described and shown herein as including a scissor support frame, it should be understood that linear guide **508** is not limited to a scissor support frame, and may have any other suitable construction that enables linear guide **508** to function as described herein. In other embodiments, for example, linear guide **508** may include linear slides, rails, rollers, rods, linear actuators, and any suitable combinations thereof that enable linear guide **508** to impart linear motion to monitor mounting frame **510**.

Linear guide **508** may also include one or more actuators or biasing elements to facilitate movement of sub-frame **522** and, in turn, monitor mounting frame **510** along first path of motion **502** towards the second position (shown in FIG. **7**). In the illustrated embodiment, for example, linear guide **508** includes first biasing elements **534** configured to bias sub-frame **522** and monitor mounting frame **510** towards the second position (shown in FIG. **7**). The illustrated embodiment includes two first biasing elements **534**, although other embodiments may include more than or less than two first biasing elements **534**. First biasing elements **534** can generally comprise any suitable biasing element that enables articulating support frame **500** to function as described herein, including, for example and without limitation, gas springs (also known as gas struts and gas shocks), mechanical springs (e.g., coil springs), pneumatic pistons, hydraulic pistons, screws, linear gear systems, and combinations thereof. In the exemplary embodiment, first biasing elements **534** are gas springs having a first end **536** coupled to mounting frame assembly **506**, and a second, opposite end **538** coupled to sub-frame **522**. In the exemplary embodiment, first biasing elements **534** are positioned on opposite sides of sub-frame **522**, although in other embodiments first biasing elements **534** may be located at any suitable position that enables linear guide **508** to function as described herein.

Linear guide **508** is configured to move sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** by a linear distance sufficient for first display monitor **404** to be moved completely out of access opening **428** and clear of (and therefore not interfere with or be obstructed by) second display monitor **406**. In the exemplary embodiment, linear guide **508** is configured to linearly move sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** by a distance of at least 10 mm, at least 20 mm, at least 30 mm, at least 40 mm, at least 50 mm, at least 75 mm, at least 90 mm, at least 100 mm, at least 110 mm, at least 120 mm, at least 150 mm, at least 200 mm, at least 250 mm, at least 300 mm, at least 350 mm, at least 400 mm, and up to 550 mm. In other embodiments, linear guide **508** may be configured to linearly move sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** by a distance less than 10 mm, or more than 550 mm.

Monitor mounting frame **510** is pivotably coupled to sub-frame **522** at pivot axis **518** via one or more pivot pins **540**. Pivot pins **540** may include any suitable bearing components that enable monitor mounting frame **510** to rotate about pivot axis **518** with respect to sub-frame **522**, as described herein. As shown in FIG. **8**, monitor mounting frame **510** and, in turn, first display monitor **404** are configured to rotate upward and away from sub-frame **522** when monitor mounting frame **510** moves along second path of motion **504** from the second position to the third, open position. In other embodiments, monitor mounting frame **510** and first display monitor **404** may rotate in any suitable direction with respect to sub-frame **522**.

Monitor mounting frame **510** and, in turn, first display monitor **404**, are configured to rotate by a sufficient amount to allow an operator or service technician to access internal compartment **426** of gaming machine **400** via access opening **428** (shown in FIG. **4**). In the exemplary embodiment, monitor mounting frame **510** and, in turn, first display monitor **404**, are configured to rotate by an angle **542** of about 60° from the second position to the third position. In other embodiments, monitor mounting frame **510** and first display monitor **404** may rotate by any suitable angle that enables the articulating support frame **500** to function as described herein. In other embodiments, for example, monitor mounting frame **510** and first display monitor **404** may rotate by an angle **542** of between 20° and 270°, between 40° and 190°, between 40° and 140°, between 80° and 180°, between 45° and 135°, between 60° and 150°, between 90° and 180°, between 60° and 120°, between 90° and 150°, between 120° and 180°, between 75° and 105°, between 90° and 120°, and between 105° and 135°.

Referring again to FIG. **9**, monitor mounting frame **510** has a substantially rectangular configuration in the exemplary embodiment, and includes a first side member **544**, a second side member **546**, and first and second cross members **548**, **550**. First and second side members **544**, **546** each include mounting ears or tabs **552** for receiving pivot pins **540** to pivotably couple monitor mounting frame **510** to sub-frame **522**. First side member **544** of monitor mounting frame **510** is pivotably coupled to first side member **526** of sub-frame **522** at the top thereof, and second side member **546** of monitor mounting frame **510** is pivotably coupled to second side member **528** of sub-frame **522** at the top thereof. In other embodiments, monitor mounting frame **510** may be coupled to sub-frame **522** at any suitable location(s) that enables the articulating support frame to function as described herein.

First display monitor **404** is coupled to monitor mounting frame **510** using any suitable fasteners that enable the articulating support frame **500** to function as described herein. In some embodiments, first display monitor **404** is coupled to monitor mounting frame **510** via slotted fasteners (e.g., pins, bolts, etc.) received in key holes **554** defined in monitor mounting frame **510** (specifically, in first and second side members **544**, **546**) such that first display monitor **404** can be de-coupled and removed from monitor mounting frame **510** by sliding first display monitor **404** relative to monitor mounting frame **510**. In one exemplary embodiment, first display monitor **404** includes a plurality of studs or shoulder washers protruding from a rear surface thereof, and each of the shoulder washers is received in a corresponding key hole **554** defined in monitor mounting frame **510**.

Articulating support frame **500** may also include one or more actuators or biasing elements to facilitate rotation of monitor mounting frame **510** and, in turn, first display monitor **404** along second path of motion **504** towards the third position (shown in FIG. **8**). In the illustrated embodiment, for example, articulating support frame **500** includes second biasing elements **556** configured to bias monitor mounting frame **510** and first display monitor **404** towards the third position (shown in FIG. **8**).

Additionally, in the exemplary embodiment, second biasing elements **556** are configured to resist or inhibit rotational motion of monitor mounting frame **510** and first display monitor **404** from the third position to the second position under the weight of the first display monitor **404**. For example, the biasing force (e.g., spring constant, pressure, etc.) of second biasing elements **556** is selected to withstand the combined weight of monitor mounting frame **510** and first display monitor **404** such that monitor mounting frame **510** and first display monitor **404** will not rotate from the third position to the second position without an external applied force. The second biasing elements **556** thereby reduce the risk of the articulating support frame **500** unintentionally closing, for example, while gaming machine **400** is being serviced.

The illustrated embodiment includes two second biasing elements **556**, although other embodiments may include more than or less than two second biasing elements **556**. Second biasing elements **556** can generally comprise any suitable biasing element that enables articulating support frame **500** to function as described herein, including, for example and without limitation, gas springs, mechanical springs (e.g., coil springs), pneumatic pistons, hydraulic pistons, screws, linear gear systems, and combinations thereof. In the exemplary embodiment, second biasing elements **556** are gas springs having a first end **558** coupled to sub-frame **522**, and a second, opposite end **560** coupled to monitor mounting frame **510**. In the exemplary embodiment, second biasing elements **556** are positioned on opposite sides of monitor mounting frame **510** and sub-frame **522**, although in other embodiments second biasing elements **556** may be located at any suitable position that enables linear guide **508** to function as described herein. Further, in the illustrated embodiment, second biasing elements **556** have the same configuration as first biasing elements **534**. In other embodiments, second biasing elements **556** may have a different configuration than first biasing elements **534**.

Articulating support frame **500** may also include one or more locks or latches to control motion of first display monitor **404** along first path of motion **502** and second path of motion **504**. As shown in FIG. **9**, for example, articulating support frame **500** includes a linear motion latch **562** and a rotational motion latch **564**. Linear motion latch **562** is configured to prevent linear motion of first display monitor **404** along first path of motion **502** when linear motion latch **562** is in a latched state, and rotational motion latch **564** is configured to prevent rotational motion of first display monitor **404** along second path of motion **504** when rotational motion latch **564** is in a latched state. When linear motion latch **562** is released from the latched state, first biasing elements **534** move or urge sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** linearly along first path of motion **502** from the first position to the second position. When rotational motion latch **564** is released from the latched state, second biasing elements **556** move or urge monitor mounting frame **510** and first display monitor **404** rotationally along second path of motion **504** from the second position to the third position. In the exemplary embodiment, linear motion latch **562** and rotational motion latch **564** operate independently of one another. For example, linear motion latch **562** is configured to be released prior to rotational motion latch **564** such that first display monitor **404** may be moved linearly along first path of motion **502** and out of access opening **428** before rotational motion latch **564** is released. Moreover, in the exemplary embodiment, rotational motion latch **564** is inaccessible when first display monitor **404** is in the first position. In other words, rotational motion latch **564** cannot be accessed prior to first display monitor **404** being moved from the first position to the second position. Having rotational motion latch **564** inaccessible when first display monitor **404** is in the first position reduces the risk of inadvertent or mistaken rotation of first display monitor **404** while in the first position, which may otherwise cause damage to first display monitor **404** or surrounding components. In other embodiments, articulating support frame **500** may include a dual-function latch that operates to restrict both linear and rotational motion of first display monitor **404**.

Linear motion latch **562** and rotational motion latch **564** may generally comprise any suitable latch mechanisms that enable the articulating support frame **500** to function as described herein. In the exemplary embodiment, each of linear motion latch **562** and rotational motion latch **564** includes a rotary latch, details of which are shown in FIGS. **11-13**. More specifically, with additional reference to FIGS. **11-12**, linear motion latch **562** includes a pair of identical rotary latches **700** coupled to respective support brackets **566** of mounting frame assembly **506**. A linear motion latch pin **702** fixedly coupled to sub-frame **522** is received within a slot **704** defined by each rotary latch **700**, and is restricted from movement when rotary latch **700** is in the latched state. Rotary latch **700** includes a release button **706** that, when depressed, actuates internal components of rotary latch **700**

to release linear motion latch pin **702** from rotary latch **700**. Linear motion latch **562** also includes a latch handle **708** (also shown in FIG. **12**) that includes bumpers **710** for engaging release button **706** of rotary latch **700**. Latch handle **708** is moveable from a first position (shown in FIGS. **10** and **11**) in which bumpers **710** are spaced apart from release button **706** to a second position (not shown) in which bumpers **710** engage release button **706** and thereby disengage rotary latch **700**, permitting movement of linear motion latch pin **702** out of slot **704** and linear motion of sub-frame **522** and components connected thereto.

With additional reference to FIG. **13**, rotational motion latch **564** includes a rotary latch **800** having the same configuration as rotary latches **700** of linear motion latch **562**. Specifically, as shown in FIG. **13**, rotary latch **800** is fixedly coupled to sub-frame **522**, and defines a slot (not shown) that receives a rotational motion latch pin **802** (also shown in FIG. **9**) fixedly coupled to monitor mounting frame **510**. Rotational motion latch pin **802** is restricted from movement when rotary latch **800** is in the latched state. A release button **804** of rotary latch is accessible by an operator by hand, for example, by reaching underneath and behind second cross member **550** of monitor mounting frame **510**. When release button **804** is engaged, rotary latch **800** is disengaged and permits movement of rotational motion latch pin **802** out of the slot and, in turn, rotational motion of monitor mounting frame **510** and first display monitor **404**. In the exemplary embodiment, when rotational motion latch **564** is released, second biasing elements **556** move monitor mounting frame **510** and first display monitor **404** along the second path of motion **504** to the third position.

The configuration of articulating support frame **500** allows first display monitor **404** to be moved out of access opening **428** without interfering with or being obstructed by surrounding components of gaming machine **400**. In particular, articulating support frame **500** is configured to move first display monitor **404** along first, linear path of motion **502** such that first display monitor **404** is moved completely out of access opening **428** without interfering with or being obstructed by second display monitor **406** or light bars. Articulating support frame **500** is further configured to move first display monitor **404** along second, arcuate path of motion **504** such that first display monitor **404** is rotated out of the way of and permits access to access opening **428**. Moreover, articulating support frame **500** does not require certain biasing elements commonly used in other door hinge assemblies, such as torsion springs or counter-weights. That is, articulating support frame **500** is free of counter-weights and torsion springs.

In operation, to move first display monitor **404** out of access opening **428** to access internal compartment **426** of gaming machine **400**, linear motion latch **562** is initially released or disengaged by actuating or pulling latch handle **708**. Pulling latch handle **708** causes bumpers **710** to engage release button **706** of rotary latches **700**, thereby releasing linear motion latch pin **702** and allowing linear guide **508** to move from the retracted position (shown in FIGS. **5** and **6**) to the extended position (shown in FIGS. **7-9**). Once linear motion latch **562** is released, first biasing elements **534** urge or move sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** along first path of motion **502** from the first position (shown in FIGS. **5** and **6**) to the second position (shown in FIG. **7**). In embodiments where first biasing elements **534** do not move sub-frame **522**, monitor mounting frame **510**, and first display monitor **404** automatically, an external force (e.g., an operator pulling on first display monitor **404**) may be applied to first display monitor **404** or other components of articulating support frame **500** to effect movement of first display monitor **404** along first path of motion **502**. As first display monitor **404** moves from the first position to the second position along first path of motion **502**, articulating support frame **500** inhibits rotation of first display monitor **404** to avoid contact or interference with adjacent components of gaming machine **400** (e.g., second display monitor **406** and light bars **420**).

After first display monitor **404** is moved to the second position and is clear of second display monitor **406** and light bars **420**, rotational motion latch **564** is released by depressing release button **804** of rotary latch **800**. Depressing release button **804** of rotary latch **800** releases rotational motion latch pin **802**, thereby allowing monitor mounting frame **510** and first display monitor **404** to rotate along second path of motion **504** from the second position to the third position (shown in FIG. **8**). Once rotational motion latch **564** is released, second biasing elements **556** urge or move monitor mounting frame **510** and first display monitor **404** along second path of motion **504** from the second position (shown in FIG. **7**) to the third position (shown in FIG. **8**). In embodiments where second biasing elements **556** do not move monitor mounting frame **510** and first display monitor **404** automatically, an external force (e.g., an operator pulling on first display monitor **404**) may be applied to first display monitor **404** or other components of articulating support frame **500** to effect movement of first display monitor **404** along second path of motion **504**.

In some embodiments, first display monitor **404** may be removed from articulating support frame **500**, for example, after first display monitor **404** is moved to the third position. In such embodiments, first display monitor **404** may be decoupled from monitor mounting frame **510** by sliding first display monitor **404** relative to monitor mounting frame **510** to disengage slotted fasteners, and subsequently removing first display monitor **404** from monitor mounting frame.

While the invention has been described with respect to the figures, it will be appreciated that many modifications and changes may be made by those skilled in the art without departing from the spirit of the invention. Any variation and derivation from the above description and figures are included in the scope of the present invention as defined by the claims.

What is claimed is:

1. An electronic gaming machine comprising:

a cabinet defining an internal compartment and an access opening that provides access to the internal compartment;

a monitor positioned within the access opening; and

an articulating support frame positioned within the internal compartment and operatively coupled to the monitor, wherein the monitor is moveable by the articulating support frame along a first, linear path of motion from a first, closed position to a second, intermediate position, and along a second, arcuate path of motion from the second position to a third, open position.

2. The electronic gaming machine of claim **1**, wherein the articulating support frame inhibits rotation of the monitor as the monitor is moved from the first, closed position to the second, intermediate position.

3. The electronic gaming machine of claim **1**, wherein the monitor is moved completely out of the access opening when moved from the first position to the second position.

4. The electronic gaming machine of claim **1**, wherein the articulating support frame comprises:

a linear guide having a proximal end fixedly coupled to the cabinet, and a distal end configured for linear movement towards and away from the proximal end; and

a monitor mounting frame pivotably coupled to the linear guide at the distal end thereof, the monitor coupled to the monitor mounting frame.

5. The electronic gaming machine of claim **4**, wherein the linear guide comprises:

a scissor support frame comprising a plurality of cross-link assemblies, each cross-link assembly comprising first and second frame members pivotably coupled to one another at a pivot point;

a sub-frame coupled to each of the plurality of cross-link assemblies at the distal end of the linear guide, wherein rotation of the first and second frame members of each cross-link assembly about the pivot point permits linear motion of the sub-frame; and

at least one biasing element coupled to the sub-frame and configured to bias the sub-frame towards second position.

6. The electronic gaming machine of claim **5**, wherein the articulating support frame further comprises a latch coupled to the sub-frame and configured to inhibit linear motion of the sub-frame in a latched state, wherein when the latch is released, the at least one biasing element moves the sub-frame along the first path of motion.

7. The electronic gaming machine of claim **4**, wherein the articulating support frame further comprises at least one biasing element operatively coupled to the monitor mounting frame and configured to bias the monitor mounting frame towards the third position.

8. The electronic gaming machine of claim **7**, wherein the articulating support frame further comprises a latch coupled to the linear guide and configured to inhibit rotation of the monitor mounting frame in a latched state, wherein when the latch is released, the at least one biasing element moves the monitor mounting frame along the second path of motion.

9. The electronic gaming machine of claim **4**, wherein the monitor is removably coupled to the monitor mounting frame by slotted fasteners such that the monitor can be de-coupled from the monitor mounting frame by sliding the monitor relative to the monitor mounting frame.

10. The electronic gaming machine of claim **1**, further comprising a mounting frame assembly, wherein the articulating support frame is fixedly coupled to the cabinet by the mounting frame assembly.

11. The electronic gaming machine of claim **1**, wherein the monitor is a first monitor, the electronic gaming machine further comprising a second monitor positioned adjacent the first monitor.

12. The electronic gaming machine of claim **11**, wherein the first and second monitors cooperatively form a curved display screen, wherein the first and second monitors adjoin one another along an edge that intersects the curved display screen.

13. The electronic gaming machine of claim **1**, wherein the articulating support frame is free of counter-weights.

14. The electronic gaming machine of claim **1**, wherein the articulating support frame is free of torsion springs.

15. A method comprising:

providing an electronic gaming machine including a cabinet defining an internal compartment and an access opening, a monitor positioned within the access opening, and an articulating support frame positioned within the internal compartment and operatively coupled to the monitor;

moving the monitor, by the articulating support frame, along a first, linear path of motion from a first, closed position to a second, intermediate position; and

moving the monitor, by the articulating support frame, along a second, arcuate path of motion from the second position to a third, open position in which the monitor permits access to the internal compartment through the access opening.

16. The method of claim **15** further comprising inhibiting rotation of the monitor as the monitor is moved along the first, linear path of motion.

17. The method of claim **15**, further comprising removing the monitor from the articulating support frame subsequent to the monitor being moved to the third position.

18. An articulating support frame for a monitor of an electronic gaming machine, the articulating support frame comprising:

a linear guide having a proximal end configured for fixedly coupling to a cabinet of the electronic gaming machine, and a distal end configured for linear movement towards and away from the proximal end; and

a monitor mounting frame pivotably coupled to the linear guide at the distal end thereof;

wherein the articulating support frame is configured to move the monitor along a first, linear path of motion from a first, closed position to a second, intermediate position, and along a second, arcuate path of motion from the second position to a third, open position.

19. The articulating support frame of claim **18**, wherein the linear guide comprises:

a scissor support frame comprising a plurality of cross-link assemblies, each cross-link assembly comprising first and second frame members pivotably coupled to one another at a pivot point;

a sub-frame coupled to each of the plurality of cross-link assemblies at the distal end of the linear guide, wherein rotation of the first and second frame members of each cross-link assembly about the pivot point permits linear motion of the sub-frame; and

at least one first biasing element coupled to the sub-frame and configured to bias the sub-frame towards second position.

20. The articulating support frame of claim **19**, further comprising at least one second biasing element operatively coupled to the monitor mounting frame and configured to bias the monitor mounting frame towards the third position.

* * * * *